Race, Genes and Health:
Public Conceptions about the Effectiveness of Race-Based Medicine and Personalized Genomic Medicine

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Abstract:

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OBJECTIVE: Personalized genomic medicine (PGM) has been lauded as the future of medicine, as new human genomic research findings are applied towards the development of screenings, diagnostic tools and treatments that are tailored to the genomic profiles of individuals. However, the development of PGM is still in its nascent stages, therefore, some have supported the development of clinical tools and treatments based on population-level characteristics, such as race or ethnicity. Race-based medicine (RBM), has been, and continues to be, promoted as an interim form of PGM, and although an academic debate has flourished over medical, social and ethical concerns related to RBM, to date, there have only been a few small studies that have examined lay beliefs and attitudes regarding RBM. The extent to which the greater American public would believe in the effectiveness of RBM and indicate an intention to use RBM is unclear. Furthermore, it is possible that racial and ethnic groups would differ in their beliefs and attitudes regarding RBM, considering RBM implies the controversial and contested conceptualization of race as having some genetic basis. Therefore, the purpose of this dissertation study was to use, for the first time, a nationally representative sample of adult Americans and examine the importance of race with respect to the following: beliefs and attitudes regarding RBM; the extent to which these beliefs and attitudes can be influenced by mass media messages about the relationship between race and genetics; and how beliefs and attitudes regarding RBM compare with those regarding PGM.

METHODS: In order to answer these questions, this dissertation study used a nationally representative sample of self-identified non-Hispanic white, non-Hispanic black and Hispanic U.S. residents who participated in an online survey examining beliefs and attitudes regarding RBM and PGM, and the effect of a vignette experiment using mock news articles that varied in their messages about the relationship between race and genes on these beliefs and attitudes. The survey assessed the following constructs using new measures designed for this dissertation study: RBM's effectiveness at the individual, clinical level; PGM's effectiveness at the individual, clinical level; preferences for using RBM; preferences for using PGM; and RBM's ability to address health inequalities in the U.S. Means, frequencies, mean-difference tests and multiple regression were used to examine the effect of race and/or the vignette experiment on beliefs and attitudes regarding RBM and PGM.

RESULTS: The results of this dissertation study show that the majority of white, black and Hispanic Americans equally agreed that RBM would *not* be clinically effective at the individual level, but the majority of all groups also equally agreed that they would prefer to use RBM if it was available. More than forty percent of all respondents who did not believe RBM would be effective at the individual level, still preferred to use a race-specific treatment if it was available. The three racial/ethnic groups examined in this study did diverge in belief in RBM's ability to reduce health inequalities. Greater portions of the black and Hispanic respondents believed RBM would be effective at reducing health inequalities than white respondents. Racial differences were also seen in the effect of the vignette experiment on RBM beliefs and attitudes. While the vignette experiment had no effect on whites' beliefs and attitudes regarding RBM, vignettes that stated or implied a genetic basis to racial difference were associated with lower endorsement of RBM beliefs and attitudes among the black respondents. Finally, the results

indicated that both white and black Americans endorsed PGM's effectiveness at the individual level at greater levels than RBM's effectiveness, and both groups indicated greater preferences for using PGM than RBM. However, while most white respondents indicated that they believed PGM would be effective at the individual level and that they would prefer to use PGM if it was available, nearly half of the black respondents did not believe PGM would be clinically effective, and 1 out of 4 black respondents did not prefer to use PGM.

CONCLUSIONS: The results suggest that white, black and Hispanic Americans do not significantly differ in their beliefs and attitudes regarding the effectiveness of or preferences for using RBM. This finding diverges from prior studies that showed racial differences in beliefs and attitudes regarding RBM. The lack of racial difference may be due to a lack of familiarity with this concept, for the results also suggested that once respondents were exposed to varying mock news article messages about the relationship between race and genes, racial differences began to emerge. The results also showed discordance between belief in RBM's effectiveness and preferences for using RBM. This finding suggests that there is still an incentive for the pharmaceutical and diagnostic testing industries to develop and market RBM even if there is generally low public opinion regarding RBM's effectiveness.

PGM has been promoted by the biomedical industry as a potential solution to racial and ethnic health disparities both in the U.S. and globally, and RBM has been promoted as an interim form of PGM until it is further developed. Despite noted clinical, social and ethical concerns regarding RBM specifically, proponents of RBM have focused on promoting the message of its potential to mitigate racial and ethnic health disparities. The results from this study indicate that on the surface at least, this argument may in fact resonate with black and Hispanic Americans.

In addition to being the first nationally representative study to examine potential racial differences in RBM beliefs and attitudes, this dissertation was also the first nationally representative study to examine potential racial differences in beliefs and attitudes regarding PGM. Although the results clearly showed that all Americans endorsed the effectiveness of and preferences for using PGM at greater levels than RBM, whites were significantly more likely than blacks to believe PGM would be clinically effective and to indicate a preference for using PGM. Thus, while the merits of PGM may seem apparent to the clinical and academic communities, the results of this study indicate that there is not universal support for PGM among the public. Cautious support for PGM from black respondents may reflect more general mistrust towards the medical community and new forms of health technologies. Even though racial and ethnic minority populations seem open to RBM and PGM as potential strategies to address health inequalities, support for both could change as the public becomes more familiar with both concepts, whether through exposure to mass media messages, mass marketing of treatments and genetic testing, or through their clinical providers.

The findings from this dissertation study significantly advance our knowledge of the American public's beliefs and attitudes regarding RBM and PGM, particularly with respect to racial differences, and should be considered by stakeholders in current and future debates surrounding efforts to develop and promote both.

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Dedication

This dissertation is dedicated to the three loves of my life, Allan, Sachie and Mari.
Everything that I have and am as a person is because of you three.

Chapter 1:

INTRODUCTION

1.1 Introduction

Personalized genomic medicine (PGM) has been lauded as the future of medicine, as new human genomic research findings are being applied towards the development of screenings, diagnostic tools and treatments that are tailored to the genomic profiles of individuals. As racial and ethnic disparities in health outcomes continue to persist, PGM is considered to be an important potential variable in the equation to improve the quality of medical care available to racial and ethnic minority populations. However, the development of PGM is still in its nascent stages. Consequently, some have supported the development of clinical tools and treatments based on population-level characteristics, such as race or ethnicity. Race- or ethnicity-specific prescribing, more commonly known as race-based medicine (RBM), has been, and continues to be, promoted as an interim form of PGM, where diagnostic tools and treatment options are developed and approved for use in specific racial and ethnic groups in an effort to improve clinical options that are available beyond conventional forms of treatments. Scientists and scholars, however, are divided over whether RBM is conceptually and realistically possible considering the fact that RBM implies there is some genetic or biological basis to racial categories. Meanwhile, the concept of race in and of itself remains controversial and contested. Even if race- and ethnicity-targeted screening tools, diagnostic tools and pharmaceutical products are proven to be more effective than conventional forms of clinical tools and treatments, there are a number of social and ethical concerns associated with RBM that raise the question of

whether potential social and ethical costs are worth RBM's development and administration, even on an interim basis.

Although an academic debate over RBM has flourished, there have only been a few small studies that have examined lay beliefs and attitudes regarding RBM. The controversial nature of RBM has been clearly established in the academic literature, as well as in some mainstream media coverage of RBM, however, the extent to which the American public would believe in the effectiveness of RBM and indicate an intention to use RBM if it was available is unclear. Therefore, the purpose of this dissertation study was to use, for the first time, a nationally representative sample of self-identified white, black and Hispanic adults who reside in the U.S. to examine the following: beliefs and attitudes regarding RBM; the extent to which these beliefs and attitudes can be influenced by mass media messages about the relationship between race and genetics; and how beliefs and attitudes regarding RBM compare with those regarding PGM. The primary independent variable that is examined in this dissertation study is race.[1] Prior exploratory studies have identified racial and ethnic differences in beliefs and attitudes regarding RBM. Because the concept of race is at the center of scientific, social, and ethical concerns and considerations surrounding RBM, and, racial and ethnic health disparities continue to persist, an examination of the extent to which racial differences exist in RBM- and PGM-related conceptions among a nationally representative sample enables stakeholders in the RBM debate to

[1] Although there are many ways in which "race" and "ethnicity" can be conceptualized and operationalized, and certainly the two concepts are generally conceptualized as distinctly different, for the purposes of brevity I will use the word "race" in this dissertation as an encompassing term to include both the concepts of race and ethnicity. I am aware of the need for precision in language, so even though "race" will be used, for the most part, as an all-encompassing term for race and ethnicity, when specificity is necessitated, I will use the word "ethnicity" in order to refer to concepts and ideas that are distinctly related to that concept (for more on "race" versus "ethnicity", see pages 19-21 in this dissertation).

better understand whether racial and ethnic minority populations specifically believe RBM and PGM would be effective and whether they would use either or both forms of treatment.

1.2 Specific Aims

In order to better understand lay beliefs and attitudes regarding RBM and PGM, and the extent to which racial differences exist in these beliefs and attitudes, I used a nationally representative sample of white, black and Hispanic Americans and unique measures of RBM- and PGM-related beliefs and attitudes to examine the following:

1. Whether racial groups differ in terms of beliefs about RBM's individual-level effectiveness, behavioral orientation towards using RBM, and beliefs about RBM's population-level effectiveness.
2. Whether racial groups differ in terms of genetic essentialist beliefs, and if so, whether genetic essentialist beliefs explain any differences between racial groups in RBM-related individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes.
3. Whether implicit racist attitudes and explicit racist attitudes towards African Americans explain some of the differences in these beliefs and attitudes between whites and Hispanics.
4. Whether experimentally varying information about the degree of genetic similarity between races affects RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs among white and black respondents.

5. Whether accepting the validity of an assigned vignette about a described relationship between race and genes is associated with differences in RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes.
6. Whether there are racial differences in PGM individual-level effectiveness and behavioral orientation beliefs and attitudes.
7. And, to what extent PGM individual-level effectiveness and behavioral orientation beliefs and attitudes compare to RBM individual-level effectiveness and behavioral orientation beliefs and attitudes.

By developing a greater understanding of the American public's beliefs and attitudes regarding RBM and PGM, stakeholders from both sides of the RBM debate will better understand whether RBM is, or has the potential to be, accepted by the lay public. Assuming RBM is proven to be clinically more effective than conventional forms of treatments, if Americans hold positive attitudes towards RBM, this receptivity, particularly from underserved and historically mistreated populations, could improve medical treatment adherence and potentially improve overall health outcomes. However, negative attitudes towards RBM means that its promotion by the pharmaceutical and biomedical industries could backfire, influencing populations who have traditionally mistrusted the healthcare system to hold even more negative attitudes towards the healthcare system. The mere existence of RBM, which suggests biological and possibly genetic distinctions between racial groups, could also lead to the re-inscription of a biological definition of race that should otherwise not exist, potentially leading to increased racist beliefs that have been associated with beliefs in genetic racial differences. Although this dissertation study will not examine these potential positive and/or negative outcomes of the

promotion of RBM, it will, for the first time, provide evidence from a nationally representative sample of white, black and Hispanic Americans of their beliefs and attitudes regarding RBM. This evidence, in turn, will enable us to better understand to what extent the lay American public would be receptive of RBM, which in turn could not only influence RBM's trajectory but, perhaps, also public conceptions of race and racial attitudes.

Chapter 2:

BACKGROUND AND SIGNIFICANCE

2.1 The Human Genome Project and the Promise of Personalized Genomic Medicine

An important goal for the Human Genome Project (HGP) was to identify genetic components of common diseases, with the hope of eventually developing treatments that could be tailored to individuals' genetic profiles. Also known as "personalized genomic medicine" (PGM), leaders and supporters of this goal have touted PGM as the future of medicine (Collins, 1999). Numerous researchers have noted, however, that the scientific and technological challenges of developing diagnostic tools and treatments individualized to the genomic profiles of individuals indicate that the goal of moving towards a biomedical system of PGM may not materialize for some time (for example, see Davies, 2006; Vera-Ramirez et al., 2010; Winkelmann and Herrington, 2010). Consequently, there is interest in the development of treatments that work more effectively in populations that share similar characteristics, such as race or ethnicity (Burchard et al., 2003; Nguyen, Desta & Flockhart, 2007; Risch, Burchard, Ziv & Tang, 2002). Significant concerns, however, have been expressed about how race-targeted pharmacogenomic products have been researched and developed, their true effectiveness for specific racial groups, and the social and ethical implications of administering different treatments based on self-identified or physician-assessed racial or ethnic identity (Benjamin, 2009; Condit & Bates, 2005; Foster, Sharp & Mulvihill, 2001; Foster & Sharp, 2002, 2004; Fujimara, Duster & Rajagopalan, 2008; Hamilton, 2008; Kahn, 2005a, 2005b, 2006, 2008, 2009, 2011; Kittles &Weiss, 2003; Lee, 2005, 2007; Lee & Mudalier, 2009; Ng, Zhao, Levy, Strausberg & Venter, 2008; Roberts, 2011). Despite these concerns expressed by social and

natural scientists, physicians, and other stakeholders, race-based medicine (RBM) continues to be a growing field, evidenced by the increasing number of patents filed by the pharmaceutical industry for new "racial" or "ethnic" drugs (Kahn, 2006). The following is a review of the literature with respect to RBM, PGM and lay conceptions about these two nascent systems of medicine.

2.2 Race: Social, Biological, or Both?

Many social and natural scientists contend that race and ethnicity are socially produced systems of classification that can have biological consequences (such as health outcome disparities) but do not necessarily reflect distinct genetic categories (Braun, 2002; Duster, 2005; Foster & Sharp, 2002, 2004; Kittles & Weiss, 2003; Reardon, 2004). In 1972, the population geneticist Richard Lewontin demonstrated that over 85 percent of observed human genetic variation occurred within racial groups while only 6 percent occurred between racial groups and 8 percent occurred between population groups (i.e., nationalities, ethnicities or tribes) within a race (Lewontin, 1972). Since that time, human genetic research has advanced significantly in large part due to the mapping of the human genome and related research through the HGP. The HGP has shown that 99.9 percent of human DNA is shared by all human beings (Collins & McKusick, 2001). Despite past and recent findings suggesting that there is little genetic variability between racial groups (however such groups are defined), a number of researchers maintain the position that there is a genetic basis to race, and some assert that there are genetic differences between races in specific traits, such as intelligence (Herrnstein & Murray, 1994; Risch et al., 2002; Rushton & Jenson, 2005; Tang et al., 2005).

The predominant understanding among most geneticists is that human genetic variation is the result of historic reasons of drift, selection and demographic history (Kittles & Weiss, 2003; Risch et al., 2002). Kittles and Weiss (2003) describe genetic differences as "isolation by distance", meaning, human genetic variation is fairly proportional to the geographic distance between human beings. "Isolation by distance" relates to the concept of "clinal", which suggests that there is gradual genetic variation among populations across the globe (Relethford, 2009). From a clinal perspective, how categories of race are distinguished is arbitrary, as there are no obvious distinctions among a continuum of genetic variation that could provide cut-off points for racial categories. Variations may have occurred as a result of adaptations made to one's physical environment, as well as mating between geographically distant individuals. The extent to which this variation across human beings can and should be classified into biologically distinct races is both arguable and controversial, however, many geneticists agree that the geographic origins of individuals' ancestors, migration, and mating patterns have had an impact on genetic variation among human beings (Kittles and Weiss, 2003; Risch et al., 2002).

Foster and Sharp (2002) are among those who contend that currently, there are no self-evident biological criteria that can be used to recruit a sufficiently heterogeneous population for the study of human genetic variation. Consequently, social categories like race, ethnicity, nationality and geographic residence are often used as proxy variables to approximate the range of variation that could exist among populations. They note an inherent paradox in the use of social classifications – while using social categories can be helpful in assembling a biologically diverse sample for genomic research, these categories imply a substantive biological significance that they do not necessarily possess. A number of scholars contend that genomic research studies examining the diversity of the human race are problematic because of their reliance on

socially produced systems of racial and/or ethnic categorization that do not accurately reflect the spectrum of diversity globally (Lee, 2005; Hamilton, 2008). While notably, there are very real challenges to designing a study of human genomic variation, Lee (2005) suggests that inclusion of populations such as people from the Middle East, South Asia and multiple regions in Africa would better capture clinal variation, thereby minimizing genomic isolation by distance among a study sample's gene pool and providing a fuller picture of genetic diversity that is not limited to only a handful of populations intentionally studied for their relatively substantial geographic distance from each other. For example, the International Haplotype Map Project (HapMap) was created to examine human genetic variation with the primary – although not exclusive – goal of understanding the haplotype blocks of single-nucleotide polymorphisms (SNPs) that contribute to human variations in disease susceptibility and treatment response (National Human Genome Research Institute, 2013). Despite the HapMap's claim that its research was sensitive to concerns about how a sample should be selected to study genomic diversity, Lee contends that the selection of sample populations that are geographically extremely separated from each other (in the case of the HapMap, people of Chinese, Japanese, Yoruban and Northern European ancestry) accentuates the genetic distance between groups, thereby reinforcing the age-old – and problematic - categorization of populations as Asian, white or black.

Genetics research thus far has employed several types of sampling and analytical strategies. However, most studies, including the HapMap, have focused on population-based sampling techniques that use self-identified race as a basis to make conclusions about genetic differences between socially-defined racial groups (Kittles & Weiss, 2003). As Duster (2005) notes, "…the particular groups of individuals chosen to represent each region of the world are often chosen because of their convenience and accessibility…" (p. 1050). This form of sampling

has been controversial for a number of reasons, including migration and mating patterns that have resulted in increasingly more heterogeneous populations globally, thereby challenging the so-called genomic "purity" of populations. In the United States, for example, racial categorization has followed the "one-drop" rule, where people are classified into a single racial category, such as black or Native American, regardless of the extent to which these populations are part of individuals' genetic ancestries (Kittles & Weiss, 2003). Therefore, self-identified race as a proxy for identifying genetic differences between populations has been considered questionable in that it ignores the variations in genetic admixture of individuals who identify with a specific racial or ethnic group. A person whose admixture is predominantly African in lineage and someone whose admixture is predominantly European may both identify as African Americans in the United States because of their phenotypes and/or shared social, cultural and familial experiences. While these two individuals may self-identify as the same racially, a mapping of the two individuals' genotypes may indicate relatively significant variation (considering the context that human beings share 99.9 percent of their DNA). Consequently, the participation of one or the other of the two in a population-based genomic research study sample could result in different conclusions about race-specific genetic differences and similarities.

Other researchers have attempted to approach genetics research from a "race-neutral" perspective (Wilson et al., 2001). Wilson and colleagues (2001) used a model-based clustering method to create genetic clusters based on the genotypes of eight ethnic populations: South African Bantu speakers; Amharic- and Oromo-speaking Ethiopians from the Shewa and Wollo provinces collected in Addis Ababa; Ashkenazi Jews; Armenians; Norwegian speakers from Oslo; Chinese from Sichuan in southwestern China; Papua New Guineans from Madang; and Afro-Caribbeans from London. Wilson et al. found through this model that the eight populations

clustered into four groups in a way that was discordant with traditional racial labels that would be used to classify these eight populations. According to their analysis, these four groups correspond to four geographical areas: Western Eurasia, Sub-Saharan Africa, China, and New Guinea. Sixty-two percent of the Ethiopians clustered into the Western Eurasia group, which also included the majority of the Jews, Norwegians and Armenians. This indicated that categorization of nearly two-thirds of the Ethiopians from this sample as "black" would not accurately reflect their genomic make-up. Other clustering results that would conflict with traditional socially-constructed race categories included the clustering of 21 percent of Afro-Caribbeans with the Western Eurasia group, and nearly all of the Chinese and Papua New Guineans clustering into separate groups instead of as a single "Asian" group. The researchers of this study conclude that clusters based on genetic structures can be more informative than racial labels for the development of pharmaceutical drugs, as well as the evaluation of these drugs for effectiveness and adverse effects.

Risch and colleagues (2002), proponents of using social race categories for genetic research, responded to Wilson and colleague's findings by contending that the clusters correspond for the most part with social race categories and that the most striking finding – that 62 percent of the Ethiopians clustered with Western Eurasia – is, in fact, not striking at all. "But it is known that African populations with close contact with Middle East populations, including Ethiopians and North Africans, have had significant admixture from Middle Eastern (Caucasian) groups, and are thus more closely related to Caucasians" (p. 4). They noted that overall, the results corresponded to the "major races" (i.e. black, white and Asian), and that the bottom line is, "Two Caucasians are more similar to each other genetically than a Caucasian and an Asian." (p. 5).

A review of the literature examining genomic research studies' sampling methodology, results, and conclusions about the relationship between race and genes clearly shows a lack of consensus regarding the relationship between race and genes. The literature also shows distinct efforts among some researchers to move from what was once understood to be the academic consensus that race is a socially constructed system of population categorization to a search for genetic verification of racial difference. The following examines the academic literature regarding RBM, including how the justification of RBM's development relates back to the bigger picture regarding the relationship between race and genes.

2.3 Race-Based Medicine

As much as the science of race remains controversial and contested, so does the concept of RBM. On the one hand, RBM presents an opportunity to redress years of unequal treatment towards racial and ethnic minority populations by the healthcare system through the provision of tailored treatments that purportedly seem to be more effective in certain populations than others (Burchard et al., 2003). In addition, there is the belief that RBM more generally could be an effective strategy for reducing racial health disparities (Risch et al., 2002; Burchard et al., 2003). On the other hand, there are a number of serious scientific, ethical and social concerns that must be considered. The following is a review of the literature regarding the scientific, medical, social and ethical concerns related to RBM. This is followed by a review of the literature on "ethnicity" as an alternative to "race" in the development of RBM. This section begins, however, with a summary of the case of BiDil, which provides an example of a number of concerns generally associated with RBM.

2.3.1 The Case of BiDil

In 2005, the United States Food and Drug Administration (FDA) approved the drug BiDil for use in treating heart failure among African Americans (Lee, 2005). BiDil is unique in that it is the first race-specific drug to have been approved by the FDA. While research has indicated that BiDil seems to help the prevention of heart failure among many people, according to Kahn (2005a, 2005b, 2008), the concept of race was exploited in order to bring this drug to the market. Kahn points out several concerns related to the approval of this drug for race-specific purposes, which both separately and in combination point to a number of scientific, social and ethical concerns that can be applied more generally to the field of RBM.

Kahn describes in detail the problems related to the clinical trial that was undertaken to test BiDil's safety and effectiveness in African Americans. Known as the African American Heart Failure Trial (A-HeFT), this clinical trial only tested BiDil's effectiveness among African Americans. By only using African Americans, the trial could not show whether BiDil had a differential level of effectiveness among African Americans compared to other racial or ethnic groups. Kahn contends that NitroMed, the company who owned BiDil's patent, was likely concerned that the clinical trial could possibly show equivalent levels of effectiveness in a comparison population, which would have meant that BiDil could be interpreted as effective for the general population. With its patent covering BiDil's approval for use in the general population set to expire in 2007, but potential patent approval through 2020 on the line for BiDil's exclusive use in the African American population if a clinical trial could prove that it is more effective among that population, NitroMed had a lot to gain financially if the clinical trial was crafted to only show BiDil's effectiveness among African Americans. Clinical trial results

showing equivalent levels of effectiveness among more than just the African American population would have meant that NitroMed would lose its patent over the drug in 2007. In addition to the questionable scientific validity of A-HeFT's results and the clear profit motive for NitroMed to gain patent approval for BiDil as an African American drug, an additional problem identified by Kahn was the loss to potential beneficiaries of BiDil who are not African American, because the clinical trial results implied that the drug is only effective among African Americans.

The case of BiDil elucidates the scientific concerns associated with a poorly designed clinical trial, medical and ethical concerns associated with recommending a drug's use in only one population when it has the potential to be effective in other populations, and ethical concerns surrounding the pharmaceutical industry's motivations behind re-branding an existing medication as a race-specific drug. BiDil, however, also taps into other social concerns, such as the potential for RBM to promote beliefs that if there are biological/genetic differences between racial and ethnic groups in their response to different medications, perhaps there are additional biological or genetic differences between racial groups in other traits, such as athletic ability, intelligence or success in life.

2.3.2 Race-Based Medicine: Scientific and Medical Considerations

The application of genetic findings based on socially constructed racial categories to the development of race-specific drugs is at the heart of the debate regarding the clinical effectiveness of RBM (Caulfield et al., 2009; Dorr & Jones, 2008; Duster, 2005; Foster and Sharp, 2002; Fujimura, Duster and Rajagopalan, 2008; Kahn, 2006, 2008, 2009, 2012; Lee, 2005, 2007; Ng, Zhao, Levy, Strausberg & Venter, 2008; Roberts, 2011). The extent to which

the genomic profiles of individuals who participate in genomic research compare to the identity of the social (i.e. racial or ethnic) groups that they self-identify with is at a minimum, inconsistent, and yet, race-specific diagnostic tools and treatments are being developed and tested for use by specific racial and ethnic groups. This is despite the fact that individuals within these groups can genetically vary as much as, if not more so than, the genetic variation between racial and ethnic groups.

In addition to scientific concerns regarding the internal and external validity of race-related genomic research and RBM clinical trials, concerns regarding the medical implications of RBM development and promotion have also been noted. One concern is that clinical providers may be less-inclined to consider alternative forms of treatment for their patients with conditions for which a race-specific drug exists that matches the patient's self-identified and/or physician-assessed racial identity. Another concern relates to people who could use a drug, but it is not prescribed to them because their self-identified or physician-assessed race does not concord with the race of those for whom the drug is meant to be used (Lee, 2005).

2.3.3 Race-Based Medicine: Social and Ethical Implications

A portion of the scientific literature concerning RBM has examined the social and ethical implications of developing RBM. One major concern is the stratification of individuals into patient groups based on both genotypic and phenotypic information (Lee, 2005). If certain phenotypes corresponding to racial or ethnic minority populations are more commonly associated with relatively rare alleles for genetic conditions, there is the potential for pharmaceutical companies to be less likely to develop treatments and diagnostic tools for those

genetic health conditions. Pharmaceutical companies may make decisions about which patient groups are financially worth investing in, resulting in smaller populations that possess rare alleles being viewed as less attractive for pharmaceutical investment. Pharmaceutical companies may decide it's not worth investing in pharmacogenomic products for relatively smaller populations like Native Americans or certain Pacific Islander populations. Additionally, because the ancestral admixture of Latinos runs the gamut, it becomes practically impossible to develop ethnicity-specific treatments for such a heterogeneous population. Lee (2005) notes that there are concerns that the number and types of drugs developed for different racial and ethnic groups may simply not be equivalent.

Although some have expressed concerns that RBM has the potential to exacerbate health disparities because focusing on the development of drugs for only certain racial groups or genomic profiles may mean that other populations will have even fewer treatment options, others have defended RBM as an important approach towards eliminating health disparities and therefore an integral contribution to the delivery of medicine. A number of researchers have called for increased genomic research using social categories of race and ethnicity in order to identify common variations in alleles between these groups and use this information to develop more diagnostic tools and treatments for racial and ethnic minority populations (Burchard, 2003; Risch et al., 2002). They maintain that social categories of race and ethnicity are relatively good approximations of group-level genomic differences that could benefit from RBM as a more tailored approach to practicing medicine than currently available conventional treatments.

Some researchers who defend the use of race as a legitimate classification system for biological research contend that the study of variations in rare alleles found among different

racial and ethnic groups will eventually enable science to mitigate health disparities (Burchard, 2003; Risch, 2002). Lee warns, however, that labeling relatively minor differences as "racial" could be both dangerous and dishonest. She notes that promotion of minor genetic differences related to these rare alleles could lead to a redefinition of social inequalities in health as biologically-based, resulting in a shift of interventions towards the clinical level, rather than the social and environmental levels that likely contain many, if not most, of the factors contributing to health disparities.

In addition to concerns that health disparities could be exacerbated if RBM leads to unequal development of treatments for different racial and ethnic groups, others have noted that increased attention to biological differences could also exacerbate health disparities. Condit and Bates (2005) contend that RBM requires heightened attention to biological differences by physicians, and because the notion of difference is a core component of racist attitudes, this attention could exacerbate discriminatory treatment by medical personnel towards minority populations. They also note that RBM could increase the already relatively high levels of mistrust towards medical authority on the part of ethnic and racial minorities, further exacerbating the reluctance of these populations to turn to the medical profession for care.

There is also the concern that the public may perceive genetic information associated with race and ethnicity as having more authority than social science information (Foster and Sharp, 2002). According to Foster and Sharp (2002), "…public perceptions of genetic information tend to collapse categories and distinctions that scientists use to maintain distance between social and genetic definitions of populations….Hence, there is a likelihood that genetic

information associated with race and ethnicity will result in the reductionary reconfiguration of those categories along simplified biological lines." (p. 848).

Duster (1990/2003) in his seminal book entitled "Backdoor to Eugenics" contends that one harmful consequence of efforts to search for race- or ethnicity-specific genetic differences in disease is that this search for what might be considered neutral and unbiased forms of difference, can in fact lead the lay public to infer that race-specific genetic differences may not stop at just disease susceptibility and health outcomes, but may include other broader human characteristics. The implications for this is that exposure to information linking race, genes and health can have as strong an effect on heightening racist beliefs and attitudes towards certain populations as linking race to genetic differences in more controversial domains, such as intelligence. Phelan, Link and Feldman (2013) tested Duster's theory through a vignette experiment using mock news articles that discussed varying types of relationships between race and genes, and found that the vignette that discussed a race-specific genetic health difference had as strong an effect on belief in essential racial differences as the vignette that broadly stated that there is a genetic basis to race. One implication of this finding is that because RBM implies that there are genetic differences between racial and ethnic groups in disease susceptibility, response to treatments and health outcomes, it is possible that the development and existence of RBM may not only reify race as a scientifically legitimate system of categorization for populations but, could also increase racist beliefs and attitudes among different populations.

2.3.4 The Conceptual Role of Ethnicity in Race-Based Medicine

"Race" and "ethnicity" are overlapping, but separate, concepts that are often used interchangeably, particularly within biomedical research (Lee, 2009; Sankar, Cho & Mountain, 2007). Perhaps because there are distinct variations in how both race and ethnicity are conceptualized, there is no simple way to define differences between the two concepts. The concept of race is extremely controversial and ranges from the biological essentialist perspective that conceptualizes race as having some biological or genetic component, to the social constructionist/constructivist perspective that conceptualizes race as being entirely a social phenomenon, albeit one with very real social and biological consequences such as race-specific health inequalities (Morning, 2011). Ethnicity, meanwhile, has generally been defined as a collective identity where the collective often shares not only a common biological ancestry, but also various beliefs and cultural symbols and practices, including language, dress, diet, religious beliefs and other norms and values (Barth, 1996; Lee, 2009; Cornell & Hartmann, 1998).

Cornell and Hartmann (1998) provide one theoretical framework by which race can be distinguished from ethnicity. They contend that ethnicity is defined by its group members and is voluntaristic – group members opt in to their ethnic identity, thereby make ethnicity an "achieved status". Meanwhile, they assert that race is a classification system imposed on people – individuals cannot opt in to or out of their racial label. They therefore describe race as an "ascribed status". Because of the history of scientific racism and biological reductionism associated with the concept of race, there have been calls for abandoning the use of race as a biomedical research variable and replacing it with ethnicity (British Medical Journal Editorial, 1996; JAMA Editorial, 2005). Others have taken this idea a step further, calling for an entirely

new method of describing populations that focuses on providing the fullest description possible of the studied population's characteristics (Bhopal & Donaldson, 1998; Fullilove, 1998). Despite the calls for abandoning race as a variable in biomedical research, race continues to be a salient and prominent focus of population research (Lee, 2009).

With respect to pharmacogenomics, the conceptual framework and related language that is used in the development of pharmaceutical products also continues to be based on the concept of race. Ethnicity is sometimes included as part of the descriptive narrative surrounding the development of pharmaceutical products tailored for use in specific racial and/or ethnic populations, but it is rarely conceptually defined as different from race or used in lieu of race (Lee, 2009; Sankar, Cho & Mountain, 2007). The conceptual challenges involved with untangling the concepts of ethnicity and race from each other point to the question of how ethnicity fits in to the development of population-targeted pharmacogenomic medicine. On the one hand, there could be a sizable number of researchers and physicians who would accept the idea that so-called "ethnic" drugs could be clinically effective for genetically more homogenous populations, such as certain indigenous tribal populations. On the other hand, it seems practically impossible to develop "ethnic" drugs for highly admixed populations such as the world's Hispanic/Latino population. Despite this latter point, FDA patent application records show that there have been efforts to develop so-called "Hispanic medications" (Kahn, 2006). Even with scientifically valid scenarios that can be envisioned for the development of "ethnic" drugs as a more nuanced alternative to the development of RBM, the many scientific, social and ethical concerns that exist surrounding RBM could still exist for ethnicity-based medicine, as evidenced by the questionable clinical effectiveness of developing medications that are meant to be broadly used only by populations who identify as Hispanic or Latino.

Unlike the calls for using ethnicity instead of race as a variable in biomedical research, there does not seem to be evidence of similar efforts to move away from the development of RBM towards the development of ethnicity-based medicine as the interim alternative to personalized genomic medicine. It is possible that this idea has not been fully explored within the literature because opponents of RBM foresee scientific, social and ethical concerns arising from the development of pharmacogenomic products for specific ethnic groups that are similar to those associated with the development of RBM.

2.4 Global, National and Corporate Stakes in Developing Race-Based Medicine

2.4.1 Global Stakes in Developing Race-Based Medicine

RBM has been touted as not only a solution to addressing health disparities between different populations within the US, but also global health disparities across different nations. In the early 1990s, the Human Genome Diversity Project (HGDP) was launched in order to study "…how and when patterns of diversity were formed [in human populations]." (p. 333, Cavalli-Sforza, 2005). HGDP, however, received numerous criticisms related to its study design and concerns about problematic assumptions made about the "composition of populations, the ontology of races and the relationship between ancient and modern people…" (p. 473, Hamilton, 2008). These and other criticisms in fact stalled the project until 2005, when the HGDP eventually received approval from the U.S. National Research Council to collect genetic data from 52 different populations in an effort to study genomic diversity, including its relationship to disease, after agreeing to follow careful informed consent and ethical procedures.

The HapMap (see page 9 for its description) was designed in part to address the critiques of the HGDP (Hamilton, 2008). However, concerns that were originally expressed about the HGDP have also been associated with HapMap. Hamilton (2008) argues that socially-constructed categories of race were integral to the HapMap's development with respect to the following: (1) the conceptualization and practice of HapMap itself and (2) the scientific and economic viability of HapMap samples, both now and in the future. Hamilton notes that socially constructed categories of race and ethnicity were involved in the selection of participants in the HapMap, which, far from being a random selection of global populations, instead was an intentional selection of distinct populations, identified by national and diasporic categories for defining populations. The HapMap's development based on socially-defined group categories inherently meant that related research findings have been shaped by HapMap's focus on certain populations. This effort to map haplotype blocks among certain national and ethnic groups has also had the potential to encourage the development of disease-specific diagnostic tools and treatments that are defined by the same racial or ethnic labels that were used to recruit the sample for the HapMap study. Although the HapMap study has not had a specific hand in the development of RBM, findings from this, the HGDP and other research studies examining the relationship between race and genes are meant to be applied to the development of new diagnostic tools and treatments, which may include race-specific genetic testing recommendations as well as race-specific pharmacogenomic treatments.

2.4.2 "Genomic Sovereignty" and Nationalist Stakes in the Development of Race-Based Medicine

Benjamin (2009) has examined the concept of "genomic sovereignty", generally defined as postcolonial nation-states' legislative or policy initiatives implemented to regulate the sampling and/or transport of genetic material from their citizens. These initiatives from nations like Mexico and India are, in part, responses to their exclusion from the HapMap project. Some of these nations have also developed their own national consortiums to map haplotype blocks of their own citizens. The goal has been to develop pharmaceutical products tailored to the genomic profiles of their citizens, including individual genomic profiles (for the development of personalized genomic medicine) as well as markers to distinguish larger groups of people (for the development of RBM). The belief is that by regulating and maintaining ownership of national genetic material, these nations are then able to develop pharmacogenomic products within their borders, thereby generating domestic profits that remain in these nations. There is also the hope that the development of tailored pharmacogenomic products will improve diagnosis, decrease side effects and their ensuing costs, and therefore lower national health care expenditures.

2.4.3 The Pharmaceutical Industry and Developing Race-Based Medicine

BiDil is the most well-known example of RBM, perhaps in part due to the fact that it was the first race- or ethnicity-specific drug approved by the FDA. However, there have been additional signs that the pharmaceutical industry has pushed for FDA approval of increasingly more race- or ethnicity-targeted pharmaceutical products. Kahn (2006) has shown after

examining FDA patent applications and approvals that the number of applications and patents approved for race-/ethnicity-targeted drugs skyrocketed following the completion of the HGP and in the wake of the approval of BiDil as a "racial" drug. According to Kahn, RBM-related patents were not issued at all between 1976 and 1997, but 12 such patents were issued between 1998 and 2005. Following the issuance of these patents, 65 race- and ethnicity-specific pharmaceutical patent applications were filed in the five-year period between 2001 and 2005.

Several scholars have examined the pharmaceutical industry's role and influence in RBM's development, noting that it has been an instrumental leader in shaping RBM's existence. For example, it has been argued that the first RBM-specific product approved for use in the U.S. occurred not as a result of biomedical leaders' and researchers' efforts to develop RBM as a new paradigm in the practice of medicine, but because of a pharmaceutical company's desire to extend its hold on a drug whose patent was about to expire (Kahn 2008, 2009).

Kahn (2009) notes that efforts to extend patents in the U.S. on previously-approved drugs haven't remained a focus within the pharmaceutical industry since BiDil's approval. However, he does argue that race and ethnicity have continued to hold featured roles in the approval of pharmaceutical product patents, as well as the marketing of products whose effectiveness has been shown to be associated with specific variations in individuals' genomic profiles. Kahn contends that companies have found ways to layer race and ethnicity on diagnostic tools and treatments that are known to be differentially effective depending on the genomic profile of individuals. Therefore, despite the availability of genetic information to target a drug's use, which is the goal of personalized genomic medicine, there have been efforts to assert that rare alleles associated with a drug's effectiveness are more prevalent in certain racial and ethnic

populations. By making this connection between alleles, race/ethnicity and a drug's effectiveness, the drug or its related genetic test's marketing potential thereby increases from a smaller pool of genomic profiles to a larger pool of racial and ethnic populations cited as being more likely to carry these alleles. This was the case with the marketing of genetic tests for the effectiveness of the widely used blood thinner warfarin, which has been documented as the second-most common drug responsible for emergency room visits in the U.S. (after insulin) and is associated with an estimated 43,000 adverse drug-related events each year (Budnitz et al., 2006). In an effort, in part, to minimize adverse episodes related to using warfarin, researchers were able to identify and isolate variations in the alleles responsible for adverse responses to the drug. Genetic tests have since been developed to identify these variants, enabling physicians to determine whether patients are more or less likely to have adverse responses to use of warfarin and thereby adjust dosing levels in order avoid an adverse reaction. However one company, AutoGenomics, has coupled its warfarin test for the three alleles most associated with warfarin response with a test for more common variants associated with specific races and ethnicities (specifically African American, Caucasian and Japanese). By expanding the profile of these tests and marketing them as being particularly effective in diagnosing warfarin response in three racial and ethnic populations representing the world's major medical markets (i.e. the U.S., Europe and Japan), Kahn contends that AutoGenomics has sought to increase its market share of pharmacogenomic diagnostic testing by linking its effectiveness to large racial and ethnic populations.

Although efforts to extend the life of U.S. patents by redirecting drugs' target populations to specific racial and ethnic groups have not been common since BiDil, Benjamin (2009) notes that the pharmaceutical industry has made significant efforts to redirect a drug's reach in

populations outside of the U.S. by seeking patent approval in other nations. Mexico, India and other nations have been targeted as "Pharma's Promised Land", where drugs that have failed in North American clinical trials or whose patents are about to expire have opportunities to be proven effective in ethnic populations outside of the U.S. Benjamin contends the pharmaceutical industry promotes investments in "niche ethnic markets" as having a dual purpose of both recouping companies' investments in drug research and development while also (theoretically) addressing the health needs of medically marginalized populations outside of North America. These efforts enable the pharmaceutical industry to minimize losses and expand profits, but they also have the subsequent effect of labeling certain drugs as "ethnic drugs" because of their purported effectiveness in allegedly more genomically homogenous populations.

2.5 Scientific and Medical Community's Beliefs and Attitudes towards Race and RBM

Among scholars who have written about RBM, there are both proponents (Burchard et al., 2003; Maglo, 2001; Nguyen, Desta & Flockhart, 2007; Risch et al., 2002) and opponents (Lee, 2005, 2007, 2009; Kahn, 2005a, 2005b, 2008, 2009; Ng, Zhao, Levy, Strausberg & Venter, 2008; Roberts, 2008, 2011) of implementing RBM. Scientists and physicians are among those at the frontlines of both developing RBM and integrating RBM into the practice of medicine. Understanding scientists' and physicians' conceptions regarding the relationship between race and genes generally, and RBM specifically, provides insight into the rationale behind scientists' beliefs regarding the application of racial and ethnic categories to human genomic research, ensuing efforts to develop RBM, and physicians' attitudes towards RBM conceptually and as a part of their clinical toolkit. The following is a review of the literature

regarding the scientific and medical communities' conceptions regarding the relationship between race and genes generally, and RBM specifically.

2.5.1 Scientists' Conceptions Regarding Race and Genes

Recent research findings seem to indicate that there is little consensus regarding scientists' conceptions of race, both within and between biological and social science disciplines. Morning's (2011) study of how scientists conceptualize and teach their students about race highlights this lack of consensus. Morning provides a framework for how diverse conceptions regarding race can be understood. She contends that race conceptualization can be categorized as based in "essentialism" or "constructivism". Essentialism contends that a given group's members share "…one or more defining qualities – "essences" – that are inherent, innate or otherwise fixed." (p. 12) These "essences" do not necessarily need to be rooted in biology, rather, they could also be whatever we believe the essence of human beings to be, for example, one's soul or psyche (Nelkin and Lindee, 1995). Morning notes that in the U.S., however, essentialism usually translates back to biological, and in particular, genetic characteristics of human beings.

Morning explains that constructivism (also known as "constructionism") runs counter to essentialism's contention that social categories reflect natural and stable differences between human groups, by asserting that social categories are "man-made" or artificial, created through a process of "social construction". She notes that constructivists do not view social groups as being unreal just because their existence is not rooted in biology. Critics of constructivism,

however, contend that this conceptualization of race denies important truths about biological reality (Frank, 2011; Gergen, 1998).

Despite prior beliefs that the academic consensus surrounding the conceptualization of race is a constructivist perspective (see Bliss, 2011 for more on this), Morning's research indicates that a constructivist/anti-essentialist view has not, in fact, taken over social and biological scientists' conceptions of race, even within her highly purposive sample of natural and social scientists, half of whom were anthropologists. There was a range of opinions in her study, from a constructivist to an essentialist perspective on race, the latter of which suggesting that there are genetic differences between racial groups. Morning also found in her examination of high school and undergraduate-level biology textbooks that the constructivist message on race was, for all intents and purposes, absent. Instead, she asserts that racial essentialism is reinforced both directly and indirectly in biology textbooks, and contends that even most social science textbooks generally fail to make a strong constructivist case for the conception of race. Her interviews with university-level students found that most students clearly identified racial constructivism with the discipline of anthropology and not nearly as much with teachings of any other discipline. She summarizes her findings on how race is taught by asserting that scientific instruction challenging biological/essentialist notions of race do not currently appear to be a pervasive feature of formal education in the U.S.

The lack of clarity regarding conceptions of race, also seems to be evident among geneticists. Hunt and Megyesi (2008) interviewed 30 human genetics researchers who used race as a variable in their genetic research about their beliefs regarding the use of race in research. Their findings showed that most geneticists in their study viewed racial variables as poorly

defined and scientifically inadequate. At the same time, they defended using these variables, arguing that race serves as a useful proxy indicator for examining human difference, until "imminent medical progress" can be made that enables scientists to move beyond the use of race as a distinguishing variable. Hunt and Megyesi found that none of the geneticists had strategies to address the inadequacies of using race as a variable, but many believed that science will eventually correct itself as progress is made.

Bliss' (2011) study of elite genomics researchers found that researchers were highly reflexive of their personal experiences as racialized subjects and, in consideration of the complex social and political forces that shape biomedical research and its technological and clinical applications, engaged in what she termed as "reflexive biosociality". She defines this concept as:

> …researchers' conscious efforts to create analytics that contribute to a future they themselves want to live in… They oscillate between policy frameworks and experiential rationales to fashion taxonomies that square with dominant values about minority inclusion and medical equality. Most use a racial taxonomy when they believe it can help racial minorities. These reflexive representation processes allow researchers to produce a social order that benefits themselves and their kin, while offering avenues for race-based sociality that make sense in the current redress-focused context. (p. 1019)

But Bliss also notes that reflexive biosociality paradoxically led the researchers in her study to simultaneously put forth social explanations for race conceptions while investing in genomics as a solution to racial quandaries.

There has been a fair amount of ethnographic work of leading pharmacogenomic laboratories and population-based biobanks that have shown that genomics researchers often uncritically align federal inclusionary standards for racial and ethnic minorities in population-based research with genomic population categories (Fullwiley, 2008; Montoya, 2011; Smart et al., 2008; Tutton, 2007; Tutton and Corrigan, 2004; Whitmarsh, 2008). Bliss notes that this practice has, in turn, produced a system where research populations are stratified by race as part of the design of the genomic research, and then targeted for race-based treatments and cures.

Overall, the literature regarding scientists' conceptions of race and its relationship with genetics indicates diverging perspectives on race conceptions, ranging from constructivist positions on race to biologically essentialized conceptions. Many scientists, particularly genomics researchers, may qualify that scientifically adequate definitions of race are lacking, but there is also a strong defense of using race in genomic research, which in turn has been justified as efforts to redress inequalities and be more inclusive of racial and ethnic minority populations in the benefits of the "genetic revolution" (Hunt and Megyesi, 2008; Fullwiley, 2008).

2.5.2 Scientists' and Physicians' Conceptions Regarding RBM

Similar to the findings on scientists' conceptions regarding the relationship between race and genetics, there seem to be diverse conceptions among scientists and physicians regarding

RBM and the importance of race and genomics in medicine. Bonham et al.'s (2009) focus group study of white and black internists found that while all of the physicians agreed that the race of patients is medically relevant, there was no consensus on why race is important. Black physicians in this study were more likely than white physicians to question the extent to which genetic research is a productive means to examine racial disparities in health, although some physicians asserted that genetics had a role to play in explaining race differences in health.

Frank et al.'s (2010) study of white and black general internists' attitudes towards RBM found that those who supported RBM believed a number of benefits could derive from race-based prescribing, including motivating patients to comply with therapy and promoting changes in health behaviors by creating the perception that the medications and therapies are tailored for them. Supporters of RBM also cited the lack of effectiveness of ace inhibitors in treating hypertension among African American patients as a specific example of differential responses to medications by race that could benefit from the development of race-targeted therapies. Some physicians, however, were concerned that there would be patients who could benefit from a "racial" drug but would not receive it because their racial heritage did not concord with the drug's targeted population. Specifically regarding BiDil, some physicians were concerned that commercial interests were the primary impetus behind the push to have it approved as an African American heart failure drug. Finally, there were physicians who indicated that they were wary that race reflected any meaningful difference at the genetic level, thereby questioning the motives behind and clinical effectiveness of RBM.

Akinniyi and Payne (2011) interviewed board-certified members of the American Association of Black Cardiologists about their BiDil prescribing patterns and found that a majority of the physicians (63.9 percent) had prescribed BiDil at some point to patients. Of

those who had prescribed BiDil, a majority of physicians used medical history (68.4 percent) to determine who should use BiDil. Some (42.1 percent) additionally, or instead, used patient's race based on the physician's own assessment to determine whether to prescribe BiDil. Nearly 37 percent of physicians used race based on a patient's self-identification to determine whether to prescribe BiDil. Also of note, 58.6 percent of the surveyed physicians believed racial groups are biologically distinct.

Égalité, □zdemir and Godard (2007) interviewed genomics researchers on their views regarding the relationship between pharmacogenomics and race. Researchers in this study noted the double-edged nature of linking pharmacogenomics and race. On the one hand, they expressed their concerns regarding the potential for racism and abuses related to prescribing race-specific treatments. On the other hand, many believed that RBM had the potential to improve health outcomes and reduce race-specific health disparities. Researchers indicated the need to follow precautionary measures related to interpreting and applying racially-categorized research findings. They also believed that their purview as genomics researchers is to provide new scientific data, and to leave the examination of socio-ethical concerns regarding their findings to bioethicists.

2.6 Lay Beliefs about and Attitudes towards Race-Based Medicine

The biomedical and ethical debates regarding RBM will continue, however, as the pharmaceutical industry moves forward to develop race-specific screening and diagnostic tools and treatments, attention should turn to whether these products will even be used. This will largely be affected by clinicians' decisions regarding whether and how to use these tools and

treatments and, notwithstanding multiple factors that affect access to healthcare services, the patient population's acceptance of and adherence to the RBM-related treatment protocols. Furthermore, patients' acceptance and use of RBM will be influenced by what they've heard about RBM. Some may be familiar with RBM because they've followed news media reporting on RBM generally, or news stories about products like BiDil, specifically (Caulfield & Harry, 2008). However because RBM is still in its nascent stages, it is more likely that most people will not be familiar with the concept until it is introduced to them by their healthcare providers or through direct-to-consumer marketing by drug companies.

The concept of race as having a genetic basis remains controversial and contested, thus, there is reason to believe that lay conceptions regarding RBM – which implies that there may be a genetic basis to racial groupings – could vary as well (Braun, 2002; Burchard et al., 2003; Duster, 2005; Foster & Sharp, 2002, 2004; Kittles & Weiss, 2003; Reardon, 2004; Risch et al., 2002; Rushton & Jenson, 2005; Tang et al., 2005). The long history of scientific racism in the United States and Europe, the details of which may not be well-known to the general public, nonetheless, is a history with which many may have some familiarity, whether it is some knowledge of efforts like the Tuskegee syphilis experiments on African American men, the Nazi experiments on Jews, or the ongoing efforts to prove that there are genetically-based intelligence differences between racial groups, which were well publicized by the mass media after the release of Herrnstein and Murray's *The Bell Curve* in 1994 (Burt, 1972; Ellis, 1998; Galton, 1869; Gould, 1981; Rushton & Jensen, 2005; Shockley, 1967; Tucker, 1994). Thus, there is reason to believe that attitudes and beliefs about race and genetics generally, and RBM specifically, could vary by race and ethnicity.

The little research that has examined lay conceptions regarding RBM's effectiveness does seem to indicate that these conceptions vary by race and ethnicity (Bevan et al., 2003; Condit et al., 2003; Marco, 2010). Bevan and colleagues (2003) reported that African American, Hispanic and multiracial American focus group participants were, on average, moderately to highly "suspicious" about drugs specifically designated for African Americans, and more suspicious than European Americans. European American respondents, while not as suspicious as their study counterparts, were nonetheless slightly suspicious. Some respondents noted their suspicions were grounded in concerns that RBM would be less effective than other drugs. Other reasons included concerns that race is more a cultural/environmental construct than genetically-based and that RBM could be damaging to one's health. This study not only found racial differences in suspicious attitudes towards RBM, but that gender modified race in these attitudes as well. Hispanic and multiracial males were the most suspicious of race-based prescribing compared to any other racial/ethnic-gender group in the study, while white males indicated the least amount of suspicion towards RBM. Another study of focus group participants also found that African American and Hispanic respondents were more suspicious than European American respondents about the safety and effectiveness of drugs designated for African Americans compared with drugs designated for European Americans (Condit et al., 2003).

To date, there is very little research that has examined whether or not the general public would use RBM. Four percent of Bevan et al.'s (2003) focus group study mentioned RBM as a preferred treatment option compared to 75 percent preferring individualized genetic testing (i.e., personalized genomic medicine) and 9 percent preferring uniform initial drug assignment (i.e., the usual course of treatment). It is unclear to what extent those who preferred individualized genetic testing would prefer either RBM or uniform initial drug assignment if individualized

genetic testing was not an option, but these data indicate a low preference for using RBM. It would be logical to assume that a preference to use RBM would be consistent with the belief that RBM is clinically effective, however, Lynch and Dubriwny (2006) found in the aforementioned study that despite suspicious attitudes towards RBM, a substantial minority of African American and Hispanic respondents believed that either they or other members of their minority group would still use RBM. Thus, past research indicates that attitudes about RBM may not always be concordant with behavioral orientation towards using RBM, particularly among racial and ethnic minority populations.

Marco's (2010) focus group study examining white and black Americans' beliefs and attitudes regarding RBM and PGM also found racial differences in attitudes towards RBM. Black respondents were generally distrustful of race-based prescribing, while white respondents expressed more positive attitudes towards RBM. Whites did express equity concerns related to RBM's development and access, but many agreed that it would be bad to miss out on more treatment options. Black respondents generally believed that RBM is inherently racist and would lead to blacks receiving inferior medications.

Butrick and colleagues (2011) conducted a vignette experiment of Americans who attended a primary care facility in the Baltimore area examining beliefs and attitudes towards RBM in comparison to PGM and conventional treatments. Unlike prior studies based on qualitative data examining beliefs and attitudes regarding RBM, this study found that whites, blacks and other racial minority groups that the sample comprised held equally negative attitudes towards RBM with respect to belief in medication efficacy and adherence intention. They note that while there are a number of plausible reasons for why racial and ethnic minority populations

would hold negative attitudes towards RBM (including concerns surrounding racial discrimination and beliefs that race is a poor proxy for underlying biology), the reasons for why whites would hold negative attitudes are less clear. They suggest that the reasons may be overlapping for whites and racial/ethnic minorities, but this similarity in beliefs could also be because of a lack of racial identity for white Americans, perhaps because they are in the racial majority. They suggest that RBM may seem irrelevant for people with little awareness of their own race.

Public support for RBM may also be affected by the extent to which Americans believe it can reduce racial inequalities in health. As health disparities continue to persist, there is hope that RBM will help close the health divide between whites and minority populations (Bevan et al., 2003; Burchard et al., 2003; Mensah, Mokdad, Ford, Greenlund & Croft, 2005; National Center for HIV/AIDS, Viral Hepatitis, STD & TB Prevention, 2010; Risch et al., 2002; Ward et al., 2004). To date, there has been no research that has examined whether the public believes this is possible, however, it may be reasonable to expect that beliefs about RBM's ability to reduce population-level inequalities would be consistent with beliefs about its individual-level effectiveness.

2.7 Factors Potentially Associated with Racial Differences in Race-Based Medicine Beliefs

As previously noted, there is some evidence to suggest that there are racial differences in RBM-related beliefs and attitudes (Bevan et al., 2003; Condit et al., 2003). Because there is relatively little empirical data available on lay conceptions about RBM in general, and by race and ethnicity specifically, significant scholarship is needed to learn more about RBM beliefs and

attitudes, including factors that may contribute to racial differences in these beliefs and attitudes. Two potential factors that may contribute to racial differences in RBM beliefs and attitudes are genetic essentialist beliefs and racial attitudes. The following is a brief summary of the literature on these two constructs.

2.7.1 Genetic Essentialist Beliefs and Race

Keller (2005) defines essentialist beliefs as "laypeople's beliefs that social categories are natural and entitative in nature." (p.686) Although there is a rich theoretical and empirical foundation for the study of psychological essentialist beliefs, particularly in how they relate to stereotyping and prejudice (for example, see Medin, 1989; Yzerbyt, Rocher & Schadron, 1997), the literature is relatively thin with respect to lay beliefs about the biological component of psychological essentialism, specifically genetic essentialist beliefs and the idea that racial differences in human characteristics are genetically-based. To date, there has been no research examining the relationship between genetic essentialist beliefs and RBM beliefs and attitudes among the lay public. However, because the clinical effectiveness of RBM would presumably be based on its ability to address biological factors associated with health conditions and diseases, it is possible that individuals who espouse genetic essentialist beliefs about physical and non-physical characteristics could be more likely than those who do not hold these beliefs to also believe that RBM should be an effective method of practicing medicine.

There are several studies that have examined lay beliefs about the relationship between genes and race. Condit and colleagues (2004) developed a model of lay understandings of the relationship between race and genetics based on findings from focus groups, a community-based

survey and a random-digit-dial telephone survey. They concluded the following from their findings: (1) most lay people identify race as being based primarily on physical features; (2) they believe that physical features are primarily genetically-based, therefore, there is a genetic basis to race; (3) they believe that "non-physical" differences in traits are caused by non-genetic factors; and (4) although they believe that there are hierarchies of races, they do not necessarily attribute these hierarchies to genetic differences. Dubriwny, Bates and Bevan (2004) found in their focus group study on lay conceptions of race and genetics that lay participants have a multifactorial definition of race where genetic variation among populations is primarily interpreted as phenotypic differences among individuals. They also found racial differences in understandings of race. African Americans were said to have a more "fluid" understanding of race that emphasized culture and included ideas of "self-definition". European Americans, however, were more likely to use physical characteristics to describe and define race.

Jayaratne and colleagues (2006) found in their study of white Americans' beliefs about the genetic basis for racial differences, that half of the respondents believed racial differences in the drive to succeed, math ability, tendency to act violently and intelligence were *not* due to genetic factors. Twenty-four percent indicated genetic factors had "very little" influence over these differences, 20 percent indicated "some" influence, 6 percent indicated "a lot" of influence, and less than 1 percent indicated that genes accounted for "just about all" of the perceived racial differences for these four traits. In Sheldon, Jayaratne, Feldbaum, DiNardo, and Petty's (2007) study of African Americans' beliefs about the relationship between genetics and race, the authors found that while only 25 percent of study participants believed that most black people think perceived racial differences are due at least in part to genes, 58 percent believed this to be the case for most white people. Reasons cited for why they believed blacks do not perceive race to

be genetic at all include: blacks' upbringing and environment; differential effects of discrimination and lack of opportunities; beliefs that there are no differences between races; and the fact that blacks are stereotyped and/or seen as different. Reasons cited for why whites might believe racial differences are due at least in part to genetics include: whites thinking that they're superior; whites' upbringing and environment; ignorance and/or not knowing blacks; and media portrayals.

2.7.2 Racial Attitudes and Beliefs about Race and Genes

To date, there is no research examining the relationship between racial attitudes and RBM beliefs and attitudes, and very little research examining the relationship between these attitudes and genetic beliefs about race. To the extent that beliefs about a genetic basis for race are positively associated with beliefs in RBM's clinical effectiveness, it seems logical to examine the literature on racial attitudes and their association with genetic essentialist beliefs about race in order to identify whether there is empirical evidence to suggest that racial attitudes may also influence beliefs about RBM's effectiveness.

Two studies have shown an association between genetic explanations for race and prejudice towards blacks. The 1986 National Election study (Kinder & Sanders, 1996) found a positive, albeit weak, association between the two constructs. Keller (2005) also found genetic explanations of race to be positively associated with racist attitudes towards African Americans. Jayaratne et al. (2006) found that white Americans who endorsed genetic explanations for perceived racial differences in the drive to succeed, math ability, the tendency to act violently and intelligence were more likely to hold traditional racial prejudice attitudes (measured as

attitudes about their hypothetical child dating or marrying a black person) as well as modern racial prejudice attitudes (which measured belief in the extent to which blacks are responsible for their lower social status). Sheldon, Jayaratne and Petty (2007) found that white Americans' endorsement of a genetic basis for a perceived race difference in athleticism between whites and blacks was associated with greater levels of prejudice towards and negative stereotyping of blacks. The findings from these four studies provide evidence that beliefs in genetic explanations for racial differences are associated with greater negative attitudes towards blacks. If genetic explanations for racial differences are positively associated with belief in RBM's effectiveness, then it is possible that racist attitudes are associated with this belief as well.

2.8 Lay Beliefs about Personalized Genomic Medicine

Similar to the literature regarding lay conceptions of RBM, the literature on lay beliefs and attitudes regarding PGM is somewhat thin. Nonetheless, there are several studies that have examined lay conceptions about PGM. As previously noted, Bevan et al. (2003) in their study of lay beliefs about RBM versus PGM or the usual course of treatment found that when given the choice, 75 percent of study participants indicated a preference for using treatment based on individualized genetic testing (i.e., PGM).

Haddy, Ward, Angley and McKinnon's (2010) focus group study of members of the public who had a chronic medical condition and/or had family members with a chronic medical condition were asked about their views on the implementation of PGM. Overall, participants believed that PGM had the potential to improve treatments, but they were concerned about issues of storage and privacy of genetic information and the costs involved with PGM. Rogausch,

Prause, Schallenberg, Brockmöller and Himmel's (2006) study of attitudes towards pharmacogenetic testing among German asthma and chronic pulmonary disease patients found that 96 percent of study participants appreciated the availability of pharmacogenetic testing for diseases like asthma, but 35 percent were fearful of potential adverse results and 36 percent were concerned about privacy issues surrounding the results. They also found social differences in attitudes – females were more likely to have fearful attitudes towards pharmacogenetic testing than males, while younger participants were more likely to be hopeful about the usefulness of pharmacogenetic testing. Meanwhile, Almarsdóttir, Björnsdóttir and Traulsenc (2005) found that focus group participants in their study on PGM attitudes were generally concerned about the ethical implications of pharmacogenomic drug development and use, mostly with respect to equitable access to these drugs and implications for local and global health inequalities.

2.8.1 Race-Based Medicine versus Personalized Genomic Medicine Beliefs and Attitudes

Several studies have examined respondents' beliefs and attitudes regarding RBM in comparison with PGM. In Bevan et al.'s study (2003) of racial differences in RBM and PGM beliefs and attitudes, PGM was substantially preferred over RBM by all study participants, however, there were several concerns associated with using PGM, including potential high costs of genetic testing and related treatment, possible privacy violations and the potential for discrimination. These concerns, however, were not as pronounced as those expressed regarding RBM. Respondents, in particular black respondents, were concerned about the following related to administration of RBM: racism; race being a "cultural" construct and therefore not an accurate proxy for differential treatment effectiveness; economic discrimination (e.g., drugs costing more

for certain racial groups); increased mistrust towards medical professionals who prescribe RBM; differential levels of effectiveness; and race-specific treatments being damaging to one's health. Some respondents discussed RBM as being akin to racial profiling, and therefore something worth avoiding.

Marco's (2010) focus group study examining white and black Americans' beliefs and attitudes regarding PGM and RBM found racial differences in its comparison of the two forms of treatment. While both whites and blacks held generally favorable views towards PGM, and both groups noted concerns about potential costs, blacks were more concerned about mistrust towards physicians being a barrier to using PGM, while whites were more concerned about possible insurance and/or employment discrimination resulting from genetic test results (the author noted a possible confusion among some respondents regarding genetic testing for disease versus genetic testing for treatment effectiveness). When discussing RBM, black respondents were very distrustful of race-based prescribing, while white respondents expressed more positive attitudes. Whites, however, did express equity concerns deriving from RBM, but many agreed that it would be bad to miss out on more treatment options. Black respondents generally believed that RBM is inherently racist and would lead to blacks receiving inferior medications. In general, both whites and blacks held more positive views towards PGM than RBM, however, whites' concerns regarding both forms of treatment seemed to focus on cost, while blacks additionally expressed concerns about racism, receipt of inferior care and mistrust towards medical providers.

Butrick and colleagues' study (2011) comparing attitudes towards PGM, RBM and conventional treatments (i.e. usual course of treatment) following a vignette experiment describing these different forms of treatments also found that respondents generally appraised RBM more negatively than PGM and the usual course of treatment. No difference was found in

attitudes towards PGM versus conventional treatment. The study found that specific to PGM, although viewed favorably, intention to adhere to such treatments was lower than adherence intention towards conventional treatment; there was no difference between white, black and other racial minorities in PGM adherence intention. Black and other racial minorities were more reluctant than whites to use PGM. The results indicated that this may be attributed to lower trust levels towards physicians among the racial minority respondents in the study. When comparing RBM to conventional treatment, the findings showed statistically significantly more negative emotion, less belief that the medicine would work, lower perceptions of respect from the RBM vignette doctor, and less willingness to take the medication for respondents assigned to the RBM vignette condition. There was no difference in these attitudes and beliefs between white and minority respondents. This study differed from prior focus group studies to the extent that both white and racial minority respondents expressed equally negative attitudes towards RBM, whereas the focus group studies (Bevan et al., 2003; Condit et al., 2003; Marco, 2010) indicated that black and other minority respondents expressed more negative attitudes towards RBM than white respondents.

2.9 Mass Media, Race and Genetics

Attitudes and beliefs about a given topic can be influenced by numerous inputs over time. Mass media, in particular, has been shown to be an important source of information and communication (Scheufele and Tewksbury, 2007; Zaller, 1992). Media coverage has also been shown to increase the importance of various topics in the public's mind, although the evidence seems to vary as to whether it can substantively influence public attitudes about a topic (Fiske,

1987; Gerbner, Gross, Morgan & Signorielli, 1980; McCombs & Shaw, 1972). Because RBM is in its early stages, it is likely that most members of the public are unfamiliar with the concept (although it should be noted that to date, RBM knowledge levels have not been studied among the general public). It is quite possible that many individuals' first introduction to this concept will be through mass media. Therefore, a review of how mass media has portrayed race, race and genetics research, and RBM is warranted in order to better understand how media coverage of RBM has the potential to influence the lay public's beliefs and attitudes about RBM. Before doing so, the following is a brief review of the literature examining mass media's influence over public opinion.

2.9.1 Mass Media's Influence over Public Opinion

As previously noted, mass media, in particular news coverage, has been shown to increase the importance of various topics in the public's mind (Fiske, 1987; Gerbner, Gross, Morgan & Signorielli, 1980; McCombs & Shaw, 1972). According to Scheufele and Tewksbury (2007), there are three major theoretical frameworks to explain how news information is relayed, processed and accepted. Agenda-setting, put forth by McCombs and Shaw (1972), contends that there is a strong correlation between mass media's emphasis of certain issues and the level of importance attributed to such issues by mass media's audiences. Priming is when news content suggests to its audience that specific issues should be used as benchmarks for evaluating the performance of leaders or the government (Iyengar and Kinder, 1987; Scheufele and Tewksbury, 2007). Priming is generally considered to be related to and an extension of agenda-setting (Scheufele and Tewksbury, 2007). The third theoretical framework for mass media's

relationship with public opinion is framing. Framing puts forth the idea that how an issue is characterized in news reports can have an influence over how it is understood by its audiences (Pan and Kosicki, 1993; Scheufele and Tewksbury, 2007). Framing as a macro-construct refers to presentation modes that mass media uses to present information in a way that comports with existing underlying schema among the target audience. As a micro-construct, framing refers to how people use information presented by mass media to form impressions on issues that were presented to them.

McQuail (1979, 1985), in his analysis of mass media's effects on public opinions, contends that subject matter that is more distant or novel to the audience and less defined by prior conceptions and personal experiences will be more successful at shaping the public's beliefs and attitudes than subject matter that is more familiar to them. Meanwhile, Zaller's (1992) research on the effects of mass media on political campaigns shows that the public tends to resist arguments that are inconsistent with their own political predispositions. Therefore, if the individual has some familiarity with or specific opinions about the subject matter, then the extent to which one is likely to accept mass media's message on this topic may have to do whether the message is consistent with his or her own beliefs and attitudes regarding that topic. However, if the topic discussed by mass media is one with which the individual has little to no familiarity, then he or she is more likely to accept the message about the topic at face value.

2.9.2 Mass Media and Race

Most research on mass media and its portrayal of race has focused on African Americans, and for that matter, television portrayals of African Americans. Past research on television

portrayals of African Americans has shown that there tends to be a focus on negative stereotypes that neither objectively nor accurately portray reality, such as depicting African Americans as inferior, lazy, unintelligent, unethical, dishonest and comical (Corea, 1993; Entman 1990, 1994; Rada, 1996). According to Rada (2000), many of the stereotypes of African Americans often seen in earlier years on television have been replaced with more subtle representations of African Americans that are consistent with the attributes of *symbolic racism*. This construct, according to Sears (1988), is characterized by three main attributes: antagonism toward African Americans for trying so hard to quickly achieve equal rights; resentment towards what is perceived as special treatment for African Americans, such as quotas for education admissions or excessive access to social welfare resources; and denial of the ongoing existence of discrimination.

2.9.3 Mass Media Portrayals of Genetics

There have been several major studies on media portrayals of genetics. Nelkin and Lindee (1995) examined the portrayal of genetics in mass media and popular culture broadly in newspapers, television, magazines, advertisements, comic books and cartoons and concluded that lay public discourse about genetics relied on genetic "essentialism" and "determinism" (note, genetic determinism is conceptualized as being akin to genetic predisposition that destines people to follow a course that cannot be altered by other factors). Conrad (1999, 2001) in his content analysis of newspapers and magazines during the 30-year period from 1965 to 1994 had several major findings. First, he found "genetic optimism" to be a predominant frame of articles that discussed genetics and mental illness during the period from the mid-1980s to mid-1990s (Conrad, 2001). The idea behind genetic optimism is simple – a gene for the disease exists; the

gene will be found; and its finding will be good. Second, Conrad concluded that news articles tended to emphasize simplistic genetic etiologies of disease (one gene, one disease) rather than more complex genomic etiologies (1999). Condit (2001), like Conrad and Nelkin and Lindee, also found that the news media tended to focus on positive portrayals of genetics, although she along with her colleagues have cautioned that the theme of genetic determinism is not as prevalent in recent years as perhaps in the past (Condit, Ofulue & Sheedy, 1998) and that fortunately, there has been an increasing emphasis on genetics-related ethical issues (Condit, 1999).

2.9.4 Mass Media Portrayals of Race and Genetics

Lynch and Condit (2006) in their analysis of newspaper articles about the relationship between race and genetics published between 1991 and 1993 (the beginning of the HGP) and 2001-2003 (the end of the HGP) found a substantial portion of articles presenting both the position that race is genetic and that race is a social construct. These articles tended to be slanted in one of the two directions, however, they concluded that the ideologically dominant position in the news during those time periods was that race is genetic, with more articles seemingly slanted in that direction. They conclude that while a wide array of scientific accounts about race and genetics were presented in the media during those time periods, many of these accounts were presented positively and only a small number of scientific accounts were challenged in the articles.

Caulfield and Harry (2008) conducted a content analysis on news articles published between 2001 and 2007 about BiDil. They found that slightly more than half of the news articles

did not mention the race controversy surrounding this drug. Among the remaining articles that did mention the race controversy, 90 percent of them explicitly discredited or questioned race as a biological construct. Thirty-two percent of the articles that focused on the controversy explicitly supported the idea of race as a social construct while most of the remaining articles raised concerns about the idea of a biological basis for race without explicitly promoting either position on the topic. They also found that the majority of articles that discussed the idea of race as a proxy for genomic variation criticized this idea. They conclude that for most of the articles that discussed race and genetics in the context of BiDil, "cautious skepticism" was the approach taken, where the relevance of genetics was not dismissed but they did not provide a deterministic view of its role. Phelan, Link and Feldman (2013) in their analysis of newspaper articles about race and genomics generally, and race, genomics and health specifically, found that race and genomics articles that focused on health issues were significantly less likely to mention racism or discuss ethical issues than articles that were not focused on health. In addition, articles that discussed health were presented in a way that much more strongly endorsed the importance of genetics than articles that did not discuss health.

2.9.5 Mass Media Influences on Lay Beliefs about Race and Genetics

There has been some examination of mass media influences on beliefs about race and genetics, particularly with respect to how they relate to health. Phelan and colleagues (2013) conducted a vignette experiment that examined the effect of varying mock news articles about the relationship between race and genes on beliefs in essential racial differences. They found that respondents exposed to a vignette about a race-specific genetic difference in heart attack risk

indicated greater belief in essential racial differences than respondents assigned to a vignette indicating race is socially constructed and respondents who were assigned to a no-vignette condition. This level of belief in essential racial differences was also virtually equal to that of respondents who were assigned to a vignette asserting that race is a genetic reality.

Condit et al. (2004) found that messages linking race, genes and health can increase racist attitudes among some audiences. They found an increase in genetically-based racism as a result of hearing such messages, although it was unclear whether this was due to increases in racism generally or an increased attribution of genes as the cause of perceived racial difference. Bates, Poirot, Harris, Condit and Achter's (2004) findings from a focus group study of lay people responding to public messages about race-specific medications indicated that people may be skeptical about messages that link race to genetics and health. They found that only 20 percent of study participants indicated belief in a mock advertising message about a drug called "Fairdil" that is supposed to be effective in reducing blood pressure among people of African descent. Reasons for resisting the message's claims about the drug included belief in individual-level genetic variation, resistance of an overgeneralization of group membership, admixture, and the perception that the message is racist. Meanwhile, a controlled experimental study that examined the effect of listening to a public service announcement linking African Americans, race, genes and health on racist attitudes found that the message increased levels of racism by almost a full point on a 5-point scale adapted from Entman and Rojecki's (2000) "Racial Denial Scale" (Parrott et al., 2005).

Lynch, Bevan, Achter, Harris and Condit (2008) examined the effect of multiple exposures to messages about genetics on general racist affect, genetically-based racism (defined

as a combination of racist affect with the belief that perceived differences in human characteristics are primarily influenced by genetics) and genetic determinism (defined as the belief that genes are the primary forces shaping individuals' lives). After multiple exposures across three time intervals to genetics messages in the form of headlines, news articles and documentaries (with topics ranging widely from genetic modification of new farm crops to the mapping of a human chromosome) the results showed that while general racist affect and genetic determinism belief did not change after repeated exposure, genetically-based racist attitudes did increase.

2.10 Summary

A review of the literature suggests that RBM is as controversial and contested as biological and genetic conceptions of race. Although to date RBM has not become the paradigm by which medicine has evolved and is practiced, the development of race- and ethnicity-targeted pharmacogenomic tools and treatments still continue (Kahn 2009, 2011). Additionally, there is evidence that physicians have integrated RBM into their clinical practices, as seen in the recent survey of board-certified physician members of the American Association of Black Cardiologists, which showed that a majority of physicians prescribed BiDil to their patients (Akinniyi & Payne, 2011). While many physicians, geneticists, and other natural and social scientists who have some hand in race and/or genomic studies may be familiar with, or knowledgeable about, RBM, it is unclear the extent to which the lay public is familiar with RBM, believes in its clinical effectiveness, and would be likely to use it.

There have been several qualitative exploratory research studies on RBM beliefs and attitudes, and most of the findings indicated that there are racial differences in these beliefs and attitudes (Bevan et al., 2003; Condit et al., 2003; Marco, 2010). One quantitative experimental study, however, diverged from these other studies by indicating that whites and racial and ethnic minorities are equally likely to hold negative attitudes towards RBM (Butrick et al., 2011). To date, however, there has been no nationally representative study of Americans' beliefs and attitudes regarding RBM. A study of this type, therefore, is warranted in order to better understand the extent to which Americans throughout the nation believe RBM could be clinically effective and whether they would even use RBM.

Because RBM is, in all likelihood, a fairly novel concept to much of the lay public, knowledge levels of and attitudes regarding RBM are most likely the result of exposure to mass media, which is among the most important sources of information regarding scientific and medical research findings and applications (Anderson, Scheufele, Brossard & Corley, 2012; Gerbner, Gross, Morgan & Signorielli, 1980; Ho, Brossard & Scheufele, 2008). A review of the literature shows that news articles about the relationship between race and genes generally, and race, genes and health specifically, have been on the rise during and following the completion of the HGP (Caulfield & Harry, 2008; Phelan, Link & Feldman, 2013). In addition, mass opinion theory suggests that members of the lay public are more likely to have their beliefs and attitudes about a topic influenced by news media and other mass communication outlets if the topic is new or less familiar to them than topics for which they have already formed opinions (Zaller, 1992). If RBM is indeed a concept with which much of the lay American public is unfamiliar, then this would suggest that even minimal exposure to news stories about RBM, or the relationship between race and genes more generally, could influence lay beliefs and attitudes regarding RBM.

Finally, if RBM is simply an interim system of medicine until PGM has developed enough to become the paradigm by which medicine is practiced, a better understanding of the lay public's beliefs and attitudes regarding PGM and how they compare to beliefs and attitudes regarding RBM is needed in order for various stakeholders to develop goals and implement strategies for ways to integrate PGM into the practice of medicine that is sensitive to the needs and concerns of the lay public. A review of the literature shows a couple of studies that have directly compared RBM with PGM, with one study (Bevan et al., 2003) indicating that the study respondents overwhelmingly indicated they would be more likely to use PGM over RBM or conventional forms of treatment, but a different study (Butrick et al., 2011) indicating that although respondents viewed PGM and conventional treatment more favorably than RBM, intention to adhere to PGM treatment was lower than adherence intention towards conventional treatment. These studies clearly show stronger support for PGM over RBM, but stakeholders interested in moving towards a medical system based on PGM should note that the support for PGM seems relatively cautious.

Chapter 3:

RESEARCH DESIGN AND METHODS

3.1 Study Overview

The data for this dissertation study were collected from the "Genetics & Stigma Study" (Jo Phelan—PI), which is a study that I was involved with as a graduate research assistant. My responsibilities included assisting with instrument development, data collection, data analysis and various administrative tasks. The aims of the Genetics & Stigma Study were twofold – first, to examine the content and volume of news articles about genetic and non-genetic causes of certain diseases and genetic causes of racial differences, and second, to examine to what extent news articles that discuss genetic or non-genetic causes of diseases or racial differences may influence stigma-related attitudes towards disease and racial attitudes and beliefs.

The second aim of the Genetics & Stigma Study was analyzed using data collected from an internet-based survey that included two different vignette experiments. This survey was part of a web panel study created by Knowledge Networks, Inc. (KN) for the American National Election Studies (ANES) Panel Study, funded by the National Science Foundation. ANES was funded to collect political information during several waves of data collection (January 2008, February 2008, June 2008, September 2008, October 2008, November 2008, and May 2009). The panel is an omnibus, meaning that in addition to the seven ANES surveys administered between January 2008 and May 2009, KN sold access to fourteen additional surveys to other clients. One of these surveys was sold to Columbia University for the Genetics & Stigma Study. These additional surveys covered a range of topics, many of which had no association with politics. The off-wave data collection months were January 2009, February 2009, March 2009,

April 2009, June 2009, July 2009, August 2009, and September 2009. Columbia University established a subcontract with KN for the company to administer the surveys that the Genetics & Stigma Study research group had developed. It was during the April 2009 wave that the Genetics & Stigma Study survey was administered.

Members of the ANES panel were recruited to participate on the panel via a phone call or a combination of a letter and phone call. Participants were told that their household had been selected to participate in a "national research study". They were also told that, "...the monthly surveys will be really interesting and they will be on a wide variety of topics that change from month to month." The panel recruitment letter and the recruitment phone script did not mention any specific type of topic that would be covered in the monthly surveys, thereby minimizing the potential for any sample selection bias due to varying levels of interest in specific survey topics.

For the Genetics & Stigma study survey, ANES panel members received an email from KN asking them to click on a link and participate in a special topic survey. Respondents were then randomized to one of seventeen different vignette experiment conditions that varied based on the Genetics & Stigma Study's two experimental variables - characteristic type and cause of characteristic discussed. Twelve of the seventeen different survey versions were for the *health vignette experiment.* The other five versions of the survey were for the *race vignette experiment.* Respondents were told via written instructions that researchers are interested in assessing how effectively print-based media conveys news-related information. The respondents were asked to read a vignette in the form of a mock news story and then answer questions about the vignette and other related topics of interest to researchers (see Appendix A for a copy of the full *health vignette experiment* survey and Appendix B for a copy of the full *race vignette experiment* survey).

Upon completion of the survey, KN mailed a $10 check to the respondents' home addresses to compensate respondents for the time they committed to participating in the Genetics & Stigma Study.

3.2 Vignette Experiment

As previously noted, each Genetics & Stigma Study participant was randomized to only one of the two vignette experiments in the study. The following sections describe the *health vignette experiment* and the *race vignette experiment*.

3.2.1 Health Vignette Experiment

In the *health vignette experiment* (N = 1687), participants were randomized to read one vignette in the form of a mock news article that varied based on two different variables – health condition and cause of the health condition. The three health conditions that varied in the vignettes were coronary artery disease, major depressive disorder and obesity. Genes, environment, personal behavior and "no cause" were the four different health condition causes that varied in this experiment. A different vignette was developed matching each of the three health conditions with each of the four health condition causes, for a total of twelve different vignettes in this experiment. Table 3.1 summarizes the different types of vignettes in the *health vignette experiment* and their corresponding mock news article titles.

It should be noted that in each vignette a lay person with the health condition was featured. The sex of the person with the described health condition was randomly varied in order

to minimize any sex-related biases that may be associated with describing a person who has coronary artery disease, major depressive disorder or obesity. Therefore, approximately half of the respondents randomized to each vignette read about a person named “Daniel Link” who had the described health condition, and the other half of the respondents read about a person named “Katherine Link” with the described health condition.

Table 3.1: Summary of vignette conditions and corresponding mock news article titles for the health vignette experiment.

Vignette Condition	Mock News Article Title
1. Coronary Artery Disease – Genetic Cause	*Coronary Artery Disease linked to Genes*
2. Coronary Artery Disease – Environment Cause	*Coronary Artery Disease linked to Pressures of Modern Life*
3. Coronary Artery Disease – Personal Behavior Cause	*Coronary Artery Disease linked to Individuals' Own Choices and Behavior*
4. Coronary Artery Disease – No Cause	*Coronary Artery Disease focus of New Research Initiative*
5. Major Depressive Disorder – Genetic Cause	*Major Depressive Disorder linked to Genes*
6. Major Depressive Disorder – Environment Cause	*Major Depressive Disorder linked to Pressures of Modern Life*
7. Major Depressive Disorder – Personal Behavior Cause	*Major Depressive Disorder linked to Individuals' Own Choices and Behavior*
8. Major Depressive Disorder – No Cause	*Major Depressive Disorder focus of New Research Initiative*
9. Obesity – Genetic Cause	*Obesity linked to Genes*
10. Obesity – Environment Cause	*Obesity linked to Pressures of Modern Life*
11. Obesity – Personal Behavior Cause	*Obesity linked to Individuals' Own Choices and Behavior*
12. Obesity – No Cause	*Obesity focus of New Research Initiative*

Each vignette was based on news articles written by either *The New York Times* or the *Associated Press*. The vignettes were similar in content, with most differences in the text related to insertion of the characteristic and cause of characteristic variables of interest, that is, health

condition and cause of the health condition. The vignettes were written so that their lengths were approximately the same. Flesch-Kincaid readability evaluations were conducted on the vignettes in order to assess the reading level required for each mock newspaper article. All of the vignettes were written at approximately the 9th or 10th grade reading level, which is about the reading level at which similar articles in the *New York Times* and the *Associated Press* were written (Smith & Smith, 1984). The vignettes were formatted using a two-column format to simulate how articles are formatted in print versions of newspapers.

With the exception of the "no cause" vignettes, each vignette discussed its assigned cause of the health condition (i.e., genes, environment or personal behavior) as the primary cause of the health condition featured in the vignette. "No cause" vignettes comprised the control arm of the *health vignette experiment*. Respondents randomized to one of the "no cause" vignettes read a mock news article about one of the three health conditions becoming the focus of a new research initiative. For the purposes of this dissertation study, only respondents who received a *health vignette experiment* vignette with no cause discussed were included in the study's analyses. All of the *health vignette experiment* "no cause" vignettes can be found in Appendix C.

Respondents were first asked several demographic questions before they were instructed to read the vignette. After reading the vignette, they were then asked a series of closed-ended questions regarding the following concepts specific to the health condition discussed in the vignette:

1. causes of the health condition and other human traits (i.e., how important are genes, the social and physical environment, and personal behaviors in causing the health condition in question, as well as other human traits, such as, general level of health);

2. genetic essentialism (transmissibility, persistence, control over and seriousness of health condition discussed in the vignette);

3. setting apart/differentness attitudes;

4. emotions (disgust, pity, anger, fear and blame related to people with the health condition);

5. helping attitudes (e.g., government assistance, health insurance coverage for people with the health condition);

6. punishment attitudes (e.g., people with the health condition should pay more for health insurance);

7. stereotypes about people with the health condition;

8. medical definition of the health condition and attitudes about medical/other types of interventions;

9. courtesy stigma (i.e. stigmatizing attitudes towards individuals who interact with people with the health condition);

10. eugenic attitudes;

11. social distancing attitudes;

12. personal exposure to the characteristic; and

13. media exposure.

Among respondents assigned to the *health vignette experiment*, only those who received a "no cause discussed" mock news article vignette for major depressive disorder, obesity or coronary artery disease were included in this dissertation study's analysis of RBM-related beliefs and attitudes. Therefore, in addition to items related to the above concepts, respondents assigned to the "no cause" vignette conditions also answered questions related to the following:

14. beliefs and attitudes regarding race-based medicine.

3.2.2 Race Vignette Experiment

In the *race vignette experiment* (N = 722), most respondents were randomized to read vignettes in the form of mock news articles about either a genetic or non-genetic cause of racial differences. Respondents were randomized to one of five different arms. Four of the five arms received a mock newspaper article that discussed some type of relationship between genes and race. The remaining arm did not receive a vignette and was therefore considered the control arm of the experiment.

Each vignette was constructed based on the content of real newspaper articles in the *New York Times* and *The Associated Press* that discussed race and genetics. Table 3.2 summarizes the five different arms of the *race vignette experiment.* The first vignette was entitled "Is race real? Genes say 'yes'", and will be referred to as the *race is genetic* vignette. This vignette makes the case that there are broad genetic differences between racial groups such as "Caucasians, Africans and Asians". The second vignette was entitled "Is race real? Genes say 'no'". This vignette will be referred to as the *social construction* vignette. In this vignette, the

readers are told that there are virtually no genetic differences between racial groups and that the labels used to distinguish people by race have little or no biological meaning.

The third vignette was entitled “Is it all black and white? Genes say ‘no’”. This vignette will be referred to as the *admixture* vignette. This vignette discusses ancestry testing, that is, a genetic test that purportedly shows from where a person’s ancestors likely derived. The vignette states that people of mixed ancestry will be able to learn the proportion of each “race” that contributes to their genetic make-up, that is, their genetic admixture. It also states that mixed ancestry is common and people who take the test are often surprised to learn that they share genetic markers with people with different skin colors.

The fourth vignette was entitled “Genes may cause racial difference in heart attacks”. This vignette will be referred to as the *genetic health difference* vignette. This mock news article states that geneticists have found a gene that raises the risk of a heart attack among African Americans by 250 percent. The vignette also states that this gene may explain why African Americans are more likely to suffer heart attacks and why such events are more likely to be fatal among African Americans. All of the *race vignette experiment* vignettes can be found in Appendix D.

Table 3.2: Summary of vignette conditions and corresponding mock news article titles for the race vignette experiment.

Vignette Condition	Mock News Article Title
1. Race is Genetic	*Is race real? Genes say 'yes'*
2. Social Construction	*Is race real? Genes say 'no'*
3. Admixture	*Is it all black and white? Genes say 'no'*
4. Genetic Health Difference	*Genes may cause racial difference in heart attacks*
5. No-Vignette Control Group	N/A

All respondents first answered questions about their feelings towards blacks or whites (non-Hispanic white respondents were asked about their feelings towards blacks, while all other respondents were asked about their feelings towards whites). All of the respondents, with the exception of those randomized to the control arm, were then instructed to read the vignette that they were randomized to receive. Among those assigned to read a vignette, after reading the vignette, respondents answered closed-ended questions that assessed their interpretation of the mock news article. All respondents were then asked to answer a series of closed-ended questions related to the following concepts:

1. beliefs about health-related racial differences;

2. beliefs about non-health-related racial differences;

3. beliefs about racial distinctiveness (i.e., racial groups are distinct or similar to each other);

4. beliefs about genetic and other factors as causes of racial differences;

5. feelings towards blacks and whites (unlike the feelings towards blacks/whites questions asked prior to reading the vignette, all respondents regardless of their self-identified race were asked the same questions);

6. beliefs about the importance of genetic and non-genetic causes of human traits (e.g., general level of health, level of intelligence, success in life);

7. social distancing attitudes;

8. beliefs and attitudes regarding race-based medicine and personalized genomic medicine;

9. contact with people of the same or different race as the respondent; and

10. media exposure.

3.3 Aims and Hypotheses

As noted previously in Chapter 1, this dissertation study is in three parts. Part 1 examines baseline beliefs and attitudes regarding RBM among non-Hispanic whites, non-Hispanic blacks and Hispanics residing in the U.S. as well as several possible mediating variables that could help explain potential racial differences in these beliefs and attitudes. Aims 1-3 and their associated hypotheses will be examined in Part 1. Part 2 examines the effects of a vignette experiment involving mock news articles that discuss genetic or non-genetic causes of racial differences on RBM-related beliefs and attitudes. Part 2 builds on Part 1 by assessing how varying information

about the relationship between genes and race potentially changes RBM-related beliefs and attitudes. Aims 4-5 and their associated hypotheses will be examined in Part 2. Part 3 examines beliefs and attitudes regarding personalized genomic medicine (PGM) and compares these beliefs and attitudes with RBM-related beliefs and attitudes. Part 3 also builds on Part 1 by examining whether there are similarities or differences in Americans' beliefs and attitudes regarding RBM and PGM. Aims 6-7 and their associated hypothesis will be examined in Part 3.

The following are the dissertation study's aims and hypotheses based on evidence and ideas that are described in the literature. Although this dissertation study examines some relatively unchartered territory, I believe that there is sufficient evidence based on prior research and broader ideas to warrant hypotheses for the dissertation's aims. It should also be noted that some of the aims and hypotheses are contingent on whether statistically significant results were found in other analyses within this study. In particular, Aims 2-3 are contingency aims that were only examined for those RBM dependent variables for which I had found racial/ethnic differences.

3.3.1 Part 1 Aims and Hypotheses: RBM-Related Beliefs and Attitudes

Aim 1. For Aim 1, I examined whether racial groups differ in terms of beliefs about RBM's individual-level effectiveness, behavioral orientation towards using RBM, and RBM's population-level effectiveness. Previous research has found that non-Hispanic blacks and Hispanics were more "suspicious" about RBM than non-Hispanic whites for a variety of reasons, including concerns that RBM would be less effective than other types of treatments (Bevan et al., 2003; Condit et al., 2003). Therefore, I expected to find that non-Hispanic whites are more likely

than non-Hispanic blacks and Hispanics to endorse RBM effectiveness beliefs and preferences for using RBM. The hypothesis for this aim is the following:

> ***Hypothesis 1***: Non-Hispanic whites are more likely than non-Hispanic blacks and Hispanics to endorse beliefs relating to and attitudes towards RBM-related individual-level effectiveness, behavioral orientation and population-level effectiveness.

Aims 2 and 3 are contingency aims that were only examined for those RBM dependent variables for which racial differences are found in Aim 1. These aims looked at two different potential mediators of racial differences in RBM-related beliefs and attitudes.

Aim 2. If racial differences were found in Aim 1, Aim 2 examined whether genetic essentialist beliefs explain any differences between racial groups in RBM-related individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes.

Several have theorized that people in socially privileged positions are more likely to endorse genetic essentialist beliefs in order to justify existing social hierarchies (Jayaratne et al., 2006; Nelkin & Lindee, 1995). Jayaratne and colleagues' (2006) study provides some support for this theory, finding that genetic essentialist beliefs among white study participants were associated with greater prejudice towards blacks. However, a study by Shostak, Freese, Link and Phelan (2009) found that, contrary to their expectations, white, socioeconomically advantaged and politically conservative study participants were not more likely than non-white, socioeconomically disadvantaged or politically liberal study participants to believe that genes are important for social or health outcomes. The evidence is therefore mixed regarding the socially advantaged being more likely to endorse genetic essentialist beliefs than the social

disadvantaged. However as previously noted, Aim 2 will only be examined if Aim 1 results indicate racial differences in RBM beliefs and attitudes. Therefore, because there has been some prior evidence that associates race with genetic essentialist beliefs, if racial differences are found in Aim 1, then it remains a possibility that genetic essentialist beliefs do mediate the relationship between race and the RBM-related dependent variables. The assumption here is that whites would be more likely to endorse genetic essentialist beliefs and that genetic essentialist beliefs would be positively associated with RBM beliefs and attitudes.

> ***Hypothesis 2***: Genetic essentialist beliefs partially mediate the association between race and RBM individual-level effectiveness belief, behavioral orientation and population-level effectiveness belief. Endorsement of genetic essentialist beliefs will be associated with endorsement of the three aforementioned RBM-related dependent variables.

Aim 3. If non-Hispanic white respondents were found to endorse RBM-related individual-level effectiveness, behavioral orientation and/or population-level effectiveness beliefs and attitudes at higher levels than non-Hispanic black or Hispanic respondents in Aim 1, then Aim 3 examined whether implicit racist attitudes and explicit racist attitudes towards African Americans explain some of the differences in these beliefs and attitudes between non-Hispanic whites and Hispanics specifically. I expected to find that non-Hispanic whites compared with Hispanics will hold more racist attitudes towards African Americans, and that these attitudes will be associated with greater endorsement of RBM's effectiveness and preferences for using RBM. Previous research has shown that whites hold more racist attitudes than Hispanics towards African Americans (Hunt, 2007). There is also some evidence that has linked racist attitudes with beliefs in biological/essential racial differences (Kinder & Sanders,

1996; Keller, 2005; Jayaratne et al., 2006). In turn, belief in biological and essential racial differences may be associated with greater endorsement of RBM's effectiveness and preferences for using it among those who assume that race-specific differences in the efficacy of biomedical treatments are due to biological differences between racial groups. Aim 3's hypotheses are in two parts:

> ***Hypothesis 3a***: Implicit racist attitudes and explicit racist attitudes towards African Americans will be associated with endorsement of RBM-related individual-level effectiveness, behavioral orientation and population-level effectiveness.
>
> ***Hypothesis 3b***: Implicit racist attitudes and explicit racist attitudes will mediate the relationship between race and RBM-related individual-level effectiveness, behavioral orientation and population-level effectiveness.

Hypothesis 3b was only tested if the analysis for Hypothesis 3a indicated an association between implicit racist attitudes and/or explicit racist attitudes and any of the tested RBM-related dependent variables.

3.3.2 Part 2 Aims and Hypotheses: Vignette Experiment's Effects on RBM Beliefs and Attitudes

Aim 4. For Aim 4, I examined whether experimentally varying information about the type of relationship between race and genes affects RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs among white and black respondents. For this aim, I compared the effects of vignettes in the form of mock news articles about the relationship between race and genes on RBM beliefs and attitudes. *If I found that the*

vignettes had an overall effect on RBM beliefs and attitudes, I would then test to see if genetic essentialist beliefs in racial differences mediates the relationship between the vignettes and the RBM dependent variables. I would then test several hypotheses that compare the effects of individual vignettes on RBM beliefs and attitudes (Hypotheses 4a-4e).

I first expected to find that the *race is genetic* and *genetic health difference* vignettes should make respondents equally likely to believe that RBM is effective and worth using because of the rationale that both vignettes underscore the idea that there are genetic differences between races, which in turn could make the lay public believe that differential responses to biomedical treatments between races are possible.

> ***Hypothesis 4a*:** There will be no significant difference in endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes between the *race is genetic* and *genetic health difference* vignettes.

I then expected to find that the *race is genetic* and *genetic health difference* vignettes made respondents more likely to believe that RBM is effective and worth using compared to the *admixture* vignette. The *admixture* vignette could affect the lay public's beliefs about race in two different ways. On the one hand, it could make some respondents believe that RBM is implausible since the vignette states that most people are racially mixed. On the other hand, it could also underscore the idea that there is some genetic basis to race, thereby validating the potential effectiveness of RBM. Because reading the *admixture* vignette could influence different segments of the public to infer opposing conceptions about the genetic basis of race (and therefore the efficacy of RBM), I expected to find that endorsement of RBM beliefs and

attitudes is lower for respondents assigned to the *admixture* vignette compared to the *race is genetic* vignette and *genetic health difference* vignette.

> ***Hypothesis 4b***: The *race is genetic* and *genetic health difference* vignettes will be associated with greater endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes than the *admixture* vignette.

I also expected to find that the *social construction* vignette does not change baseline beliefs about RBM. I predicted that those who believe races are similar will have their belief reinforced by this vignette and those who believe races are genetically different will not change their views as a result of the vignette. This is because the *social construction* vignette message has been viewed as the generally-accepted conceptualization of race and is therefore not presenting a new perspective to the lay public. If this is in fact the case, there should be no difference between those who received the *social construction* vignette and those assigned to the control condition for RBM beliefs and attitudes.

> ***Hypothesis 4c*:** There will be no significant difference for RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes between the *social construction* vignette and control condition.

If no significant differences in RBM beliefs and attitudes are found between respondents who received the *social construction* vignette and those randomized to the control condition, then I also expect to find that respondents who received the *admixture* vignette are more likely to endorse RBM beliefs and attitudes than respondents who received the *social construction* vignette or were assigned to the control condition. This is because for some *admixture* vignette

respondents, the vignette could underscore the idea that there is some genetic basis to race, thereby validating the potential effectiveness of RBM.

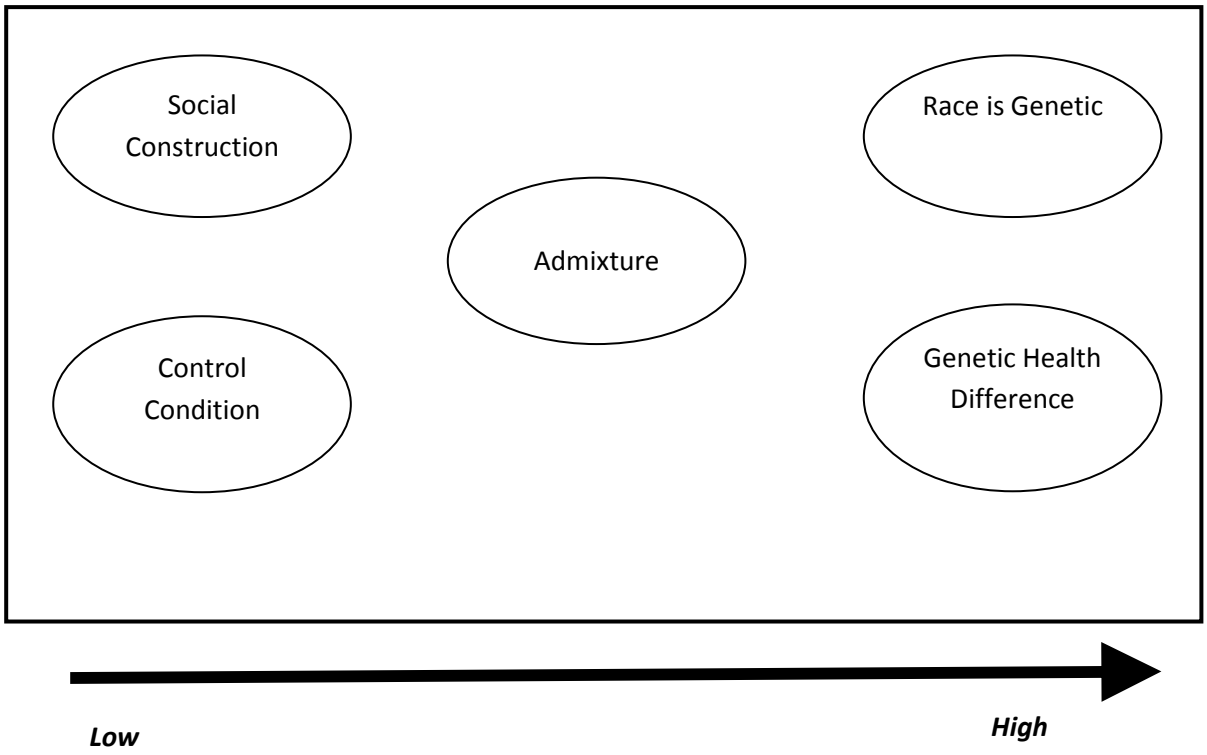
> ***Hypothesis 4d:*** The *admixture* vignette will be associated with greater endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes than the *social construction* vignette and the control condition.

I will then directly test to see if exposure to either the *race is genetic* or *genetic health difference* vignettes is associated with higher endorsement of RBM beliefs and attitudes then either exposure to the *social construction* vignette or the no-vignette control condition.

> ***Hypothesis 4e:*** The *race is genetic* and *genetic health difference* vignettes will be associated with greater endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness than the *social construction* vignette or the no-vignette control condition.

Figure 3.1 visually summarizes hypotheses 4a through 4e by displaying the hypothesized endorsement levels for the RBM dependent variables by vignette type.

Figure 3.1: Hypothesized relative endorsement levels of RBM beliefs and attitudes by vignette type.



Aim 5. For this aim, I examined whether acceptance of the vignette is associated with differences in RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes. Specifically, I examined whether acceptance of the information provided in the vignette modified the relationship between the vignette and RBM beliefs and attitudes. Exposure to one mock news article that discusses the relationship between race and genetics may not have been enough to influence beliefs and attitudes about RBM. The extent to which the respondent accepted the information provided in the vignette could be the ultimate factor that influenced RBM beliefs and attitudes in this experiment.

Hypothesis 5a: There will be a significant difference between the *social construction* and *race is genetic* vignettes in the association between vignette acceptance and RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes such that greater vignette acceptance will be associated with lower endorsement of RBM beliefs and attitudes for the *social construction* vignette while greater vignette acceptance will be associated with higher endorsement of RBM beliefs and attitudes for the *race is genetic* vignette.

Hypothesis 5b: There will not be a significant difference between the *genetic health difference* vignette and the *race is genetic vignette* in the association between vignette acceptance and RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes. Greater vignette acceptance should be associated with greater endorsement of RBM beliefs and attitudes for both vignettes.

Hypothesis 5c: There will be a significant difference between the *admixture* vignette and the *race is genetic* vignette in the association between vignette acceptance and RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes. Greater acceptance of the *admixture* vignette will be associated with relatively lower endorsement of RBM beliefs and attitudes while greater acceptance of the *race is genetic* vignette will be associated with higher endorsement of these attitudes and beliefs.

Hypotheses 5a through 5c are based on the conceptual framework visualized in Figure 3.1, which hypothesizes that the *social construction* vignette will be associated with the lowest endorsement levels of RBM beliefs and attitudes, the *admixture* vignette will be associated with mid-range

endorsement levels of RBM beliefs and attitudes, and the *race is genetic* and *genetic health difference* vignettes will be associated with the highest endorsement levels of RBM beliefs and attitudes.

3.3.3 Part 3 Aims and Hypotheses: PGM Beliefs and Attitudes

Aim 6. For Aim 6, I examined whether there are racial differences in personalized genomic medicine (PGM) individual-level effectiveness and behavioral orientation beliefs and attitudes. Past research has shown some racial differences in genetic technology-related beliefs and attitudes. Differences in genetic testing rates among different racial and ethnic groups have been reported (Singer, Antonucci & Van Hoewyk, 2004). Utilization of PGM is predicated on genetic testing in order for treatment to be personalized to one's genomic profile. If there currently are racial and ethnic differences in utilization of genetic technology, it is possible that there are racial and ethnic differences in beliefs about PGM's effectiveness. According to Singer and colleagues (2004), although whites were more likely to use genetic testing, blacks and Hispanics were more likely to express preferences for prenatal and adult genetic testing than whites. However, blacks may also hold other beliefs and attitudes that conflict with or over-ride these attitudes in specific situations, such as concerns about cost, discrimination or general mistrust towards medical authority (Hipps, Roberts, Farrer & Green, 2003; Robert, 2011; Thompson, Valdimarsdottir, Jandorf & Redd, 2003). Therefore, on the one hand it is possible that blacks are more likely to believe in PGM's effectiveness and to be behaviorally oriented towards using PGM. On the other hand, it is possible that whites are more likely than blacks to endorse PGM's effectiveness if whites' higher rates of genetic testing reflect (at least in part)

greater belief in the effectiveness of treatments that result from genetic testing, or, because concerns like cost, discrimination and medical mistrust regarding health care and health-related technologies more broadly are extended towards blacks' beliefs regarding the effectiveness of PGM. It therefore seems logical to predict that non-Hispanic blacks would be less likely to endorse the effectiveness of PGM and less likely to prefer using PGM than non-Hispanic whites.

> ***Hypothesis 6:*** Non-Hispanic whites will be more likely than non-Hispanic blacks to endorse the individual-level effectiveness of PGM and to prefer to use PGM.

Aim 7. Aim 7 examines PGM individual-level effectiveness and behavioral orientation beliefs and attitudes in comparison to RBM individual-level effectiveness and behavioral orientation beliefs and attitudes. Much of the support among researchers and clinicians for RBM has been grounded in the belief that it is an acceptable interim alternative until a system based on PGM can be realized (Burchard et al., 2003; Risch et al., 2002). There is currently very little data that examines public beliefs about PGM on its own and in comparison to RBM. Because some in the biomedical industry support the idea of RBM as an interim alternative for PGM, it seems reasonable to examine the extent to which the public would support this idea. One focus group study found that respondents overwhelmingly preferred PGM in comparison to RBM. Based on this prior research study, I expected to find that respondents in this dissertation study will also endorse PGM beliefs and attitudes at greater levels than RBM beliefs and attitudes.

> ***Hypothesis 7***: Mean endorsement levels of PGM individual-level effectiveness and behavioral orientation will be greater than the mean endorsement levels of RBM individual-level effectiveness and behavioral orientation.

Table 3.3 summarizes all of the aims and hypotheses for Parts 1-3 of this dissertation study.

Table 3.3: Summary of Aims and Hypotheses.

Part 1 -- RBM Beliefs and Attitudes Research Questions:

- **Do white, black and Hispanic Americans hold similar or differing beliefs and attitudes regarding RBM?**
- **What factors influence potential racial differences in beliefs and attitudes regarding RBM?**

Aims	Hypotheses
Aim 1: Examine whether racial groups differ in terms of beliefs about RBM's individual-level effectiveness, behavioral orientation towards using RBM, and RBM's population-level effectiveness.	***Hypothesis 1***: Whites are more likely than blacks and Hispanics to endorse beliefs relating to and attitudes towards RBM-related individual-level effectiveness, behavioral orientation and population-level effectiveness.
Aim 2: First, examine whether racial groups differ in terms of genetic essentialist beliefs. Second, if racial differences were found for genetic essentialist beliefs, examine whether genetic essentialist beliefs explain any differences between racial groups in RBM-related individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes.	***Hypothesis 2***: Genetic essentialist beliefs partially mediate the association between race and RBM individual-level effectiveness belief, behavioral orientation and population-level effectiveness belief. Endorsement of genetic essentialist beliefs will be associated with endorsement of the three aforementioned RBM-related dependent variables.
Aim 3: Examine whether implicit racist attitudes and explicit racist attitudes towards African Americans explain some of the differences in these beliefs and attitudes between whites and Hispanics.	***Hypothesis 3a***: Implicit racist attitudes and explicit racist attitudes towards African Americans will be associated with endorsement of RBM-related individual-level effectiveness, behavioral orientation and population-level effectiveness. ***Hypothesis 3b***: Implicit racist attitudes and explicit racist attitudes will mediate the relationship between race and RBM-related individual-level effectiveness, behavioral orientation and population-level effectiveness.

Table 3.3: Summary of Aims and Hypotheses.

Part 2 -- Mass Media's Effects on RBM Beliefs and Attitudes Research Question: • **Does varying messages about the relationship between race and genes influence RBM beliefs and attitudes?**	
Aims	**Hypotheses**
Aim 4: Examine whether experimentally varying information about the degree of genetic similarity between races affects RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs among white and black respondents.	***Hypothesis 4a*:** There will be no significant difference in endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes between the *race is genetic* and *genetic health difference* vignettes. ***Hypothesis 4b***: The *race is genetic* and *genetic health difference* vignettes will be associated with greater endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes than the *admixture* vignette. ***Hypothesis 4c*:** There will be no significant difference for RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes between the *social construction* vignette and control condition. ***Hypothesis 4d:*** The *admixture* vignette will be associated with greater endorsement of RBM individual-level effectiveness, behavioral orientation and population effectiveness beliefs and attitudes than the *social construction* vignette and the control condition. ***Hypothesis 4e:*** The *race is genetic* and *genetic health difference* vignettes will be associated with greater endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness than the *social construction* vignette or the control condition.
Aim 5: Examine whether acceptance of the vignette is associated with differences in RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes.	***Hypothesis 5a:*** There will be a significant difference between the *social construction* and *race is genetic* vignettes in the association between vignette acceptance and RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes such that greater vignette acceptance will be associated with lower RBM belief levels for the *social construction* vignette while greater vignette acceptance will be associated with higher RBM belief levels for the *race is*

Table 3.3: Summary of Aims and Hypotheses.

	genetic vignette. ***Hypothesis 5b:*** There will not be a significant difference between the *genetic health difference* vignette and the *race is genetic vignette* in the association between vignette acceptance and RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes. Greater vignette acceptance should be associated with greater endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes for both vignettes. ***Hypothesis 5c:*** There will be a significant difference between the *admixture* vignette and the *race is genetic* vignette in the association between vignette acceptance and RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes. Greater acceptance of the *admixture* vignette will be associated with relatively lower endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes while greater acceptance of the *race is genetic* vignette will be associated with higher endorsement of these attitudes and beliefs.
Part 3 -- PGM Beliefs and Attitudes Research Questions: • **Do white and black Americans hold similar or different beliefs and attitudes regarding PGM?** • **How do beliefs and attitudes regarding PGM compare with those regarding RBM?**	
Aims	**Hypotheses**
Aim 6: Examine whether there are racial differences in PGM individual-level effectiveness and behavioral orientation beliefs and attitudes.	***Hypothesis 6:*** Non-Hispanic whites will be more likely than non-Hispanic blacks to endorse the individual-level effectiveness of PGM and to prefer to use PGM.
Aim 7: Examine PGM individual-level effectiveness and behavioral orientation beliefs in comparison to RBM individual-level effectiveness and behavioral orientation beliefs.	***Hypothesis 7***: Mean endorsement levels of PGM individual-level effectiveness and behavioral orientation will be greater than the mean endorsement levels of RBM individual-level effectiveness and behavioral orientation.

3.4 Sample Overview

In this chapter I will provide an overview of the survey's sample. Different sub-samples were used to analyze the aims in this study, depending on with which of the three study parts the aims are associated. Socio-demographic analyses of the sub-samples will be described in the separate results chapters for Parts 1-3 (i.e., Chapters 4-6). Reasons for why different sub-samples had to be used are discussed below.

The target population for the survey's sample was persons aged 18 or older living in households with telephones in the United States. The sampling frame was a list-assisted random-digit-dialed telephone frame. Two strata were designated using 2000 Census Decennial data. The first stratum had a higher concentration of black and Hispanic households and the second stratum had a lower concentration relative to national estimates, however, the first stratum was sampled at a higher rate. KN was able to obtain a valid postal address for 60-70 percent of telephone numbers in the two stratums. Those telephone numbers for which addresses were available were selected with certainty into the sample, while 75 percent of the remaining telephone numbers were subsampled at random. The address-matched phone numbers received an advance mailing informing them that their household was selected to participate in an ongoing monthly study sponsored by Stanford University, the University of Michigan and the National Science Foundation.

The telephone recruitment process began for all sampled phone numbers after the advance mailing. The cases that were sent to interviewers were dialed for up to 90 days, with at least 19 dial attempts made for cases where the phone went unanswered, as well as for numbers known to be associated with households. KN interviewers attempted extensive refusal

conversions in those cases where it was necessary. Within each household, all members aged 18 and older were enumerated and a member was selected at random to participate on the panel. Recruitment interviews typically took about 10 minutes.

The Genetics & Stigma Study, as well as all other waves of the ANES study, was conducted as an online survey. Thus, households that did not have internet access were offered access via the MSN TV service network. In these cases, the household was sent a MSN TV2 unit that was custom configured with an individual email account so that it was ready for immediate use by the selected panelist. All new MSN TV2 panel members were sent an initial survey to confirm proper installation of the equipment and help familiarize them with the unit.

Following recruitment onto the panel, all new panel members completed a follow-up survey asking for demographic information such as sex, age, race, income and educational attainment, which were used to create member profiles. Panel members received $10 for each completed survey. The Genetics & Stigma Study survey was conducted in English between April 9 and May 7, 2009 with 2,409 respondents. The completion rate was 66 percent.

As previously noted, panel members were randomized to participate in only one of the two vignette experiments. The *health vignette experiment* had 1,687 respondents and the *race vignette experiment* had 722 respondents. Sub-samples of both vignette experiments were used for the analyses in this dissertation. Analyses for Aims 1-3, which focus on racial differences in baseline attitudes and beliefs regarding RBM, were conducted on data collected from 411 self-identified non-Hispanic white (from here on out referred to as "white"), non-Hispanic black (from here on out referred to as "black") and Hispanic adults who were randomized to the control arm of the *health vignette experiment*. Analyses for Aims 4-7 were conducted on data

collected from 632 self-identified white and black adults who were randomized to the *race vignette experiment*. The reason for why Aims 1-3 used the control group from the *health vignette experiment* instead of the *race vignette experiment* is because the former experiment's control condition had a substantially larger sample size and a relatively greater proportion of black and Hispanic respondents compared to the *race vignette experiment's* control arm. In addition, while combining the control arms of both experiments was possible for examining baseline RBM beliefs and attitudes, doing so meant that I would be unable to test the hypothesized mediating variable in Aim 2 (genetic essentialist beliefs) because the *race vignette experiment* sample did not receive the items for this construct in its survey.

3.5 Measures

With the assistance of Jo Phelan and her research team, I have developed new measures assessing beliefs about, and behavioral orientation towards using, RBM and PGM. In all, five new measures were constructed and used in the analyses for this dissertation. These five measures are the dependent variables that were used for all of the dissertation's analyses. I should note that although I was involved with the Genetics & Stigma Study from the start, this dissertation's data needs was not the primary focus of that study, therefore, I was limited as far as the number of items that could be inserted into the survey. I was able to insert what I predicted would be the minimum number of items required to be able to test the hypotheses presented in this study, however, some items – such as ones needed to measure RBM and PGM knowledge levels – would have been useful to include, but could not be included due to limited space available in the survey for items needed in this dissertation.

The following describes the independent variables, dependent variables, mediators, moderator and covariate variables that were used in this dissertation study.

3.5.1 Independent Variables

For Aims 1-3, parts of Aims 4-5, and Aims 6-7, race/ethnicity was the primary independent variable used. Race/ethnicity was self-reported by the respondent and was obtained through the initial recruitment interview. Respondents were asked during the recruitment interview, "For classification purposes, can you please tell me if you are of Spanish or Hispanic origin?" They were then asked about their race, "Now I'm going to read you a list of categories. Please choose one or more of the following categories to describe your race. Are you white, black or African American, American Indian, Alaska Native, Asian, Native Hawaiian or Pacific Islander?" "Dummy" variables were created for the categories of "white", "black" and "Hispanic" for the multiple linear regression analyses, with "black" and "Hispanic" valued at 1 and "white" valued at 0 (the referent category).

The independent variable for Aim 4 is the *race vignette*. For this analysis, "dummy" variables were created using the no-vignette control condition as the referent category, except when indicated. Dummy variables were created for all four vignettes to which respondents were randomized in this experiment – the *race is genetic, social construction, admixture*, and *genetic health difference* vignettes.

3.5.2 Dependent Variables

The dependent variables are measures of beliefs about and behavioral orientation towards using RBM and PGM. The measures are: RBM individual-level effectiveness, RBM behavioral orientation, RBM population-level effectiveness, PGM individual-level effectiveness, and PGM behavioral orientation. These measures are new constructs that I developed along with Jo Phelan and her research team. It should be noted that multi-item measures in the form of scales are generally preferable to single-item measures because they are more likely to capture the complexity of the underlying construct that is being measured (DeVellis, 2003). Although I was able to develop two scales to respectively measure RBM individual-level effectiveness and PGM individual-level effectiveness, because I was limited in the overall number of items that I could include in the survey, the RBM and PGM behavioral orientation measures, and the RBM population-level effectiveness measure, are single-item measures.

I was unable to collect data on knowledge levels about RBM or PGM, however, I believe it is reasonable to assume that much, if not most, of the American public is unfamiliar with these concepts. Thus, a brief introduction that defined RBM and PGM to respondents was provided prior to the section of the survey with the related items. Respondents who participated in the control arm of the *health vignette experiment* were only administered RBM-related items and therefore received the following introduction prior to this section of the survey:

The following questions ask about race-based medicine. Race-based medicine customizes medical treatments for specific racial groups. For example, the drug BiDil was developed by a

company for use among only African Americans as a treatment for heart failure. Even if you are unfamiliar with these topics, we are interested in your opinions.

Respondents who participated in the *race vignette experiment* were administered both the RBM- and PGM-related items and therefore read the following in their introduction to these items:

The following questions ask about race-based medicine and personalized medicine. Race-based medicine customizes medical treatments for specific racial groups. For example, the drug BiDil was developed by a company for use among only African Americans as a treatment for heart failure. Personalized medicine is individualized medical care based on a person's genetic profile. Whereas race-based medicine is medical care that is customized to meet the needs of specific racial groups, personalized medicine is medical care that is customized to meet the needs of individual people based on their genetic differences. Even if you are unfamiliar with these topics, we are interested in your opinions.

The response format for all of the dependent variables was the following: "strongly agree", "somewhat agree", "somewhat disagree" and "strongly disagree".

3.5.2.1 Race-Based Medicine Individual-Level Effectiveness

A factor analysis was conducted in order to evaluate the extent to which the four items developed to assess RBM individual-level effectiveness related to each other. The number of factors was not specified in the analysis. All four RBM-related items loaded onto one factor. Two of the items, however, did not fit as well as the other two items within the factor solution. Item loadings for the one factor solution ranged from .499 to .913.

Despite the factor analysis' results indicating that two of the items are weaker at measuring the underlying construct, the one factor solution still suggested that all of the items are related. Therefore, a scale was constructed using all four items to measure the construct of RBM individual-level effectiveness. The individual items that the scale comprises are:

(1) "We could do a better job of treating coronary artery disease if drugs were developed for specific racial groups."

(2) "Medications would work better if they were created for use in specific racial groups."

(3) "In my opinion, we should only develop drugs that can be used by everyone regardless of their race." (reverse-coded)

(4) "If coronary artery disease drugs were made for use with different racial groups, I would prefer to use the one designed for my racial group."

An internal consistency reliability analysis of the RBM individual-level effectiveness scale indicated that internal consistency reliability is good for this measure. Cronbach's alpha for the sample as a whole was .76. For the white respondents it was .77, for black respondents it was

.73 and for Hispanic respondents it was .88. Cronbach's alpha was also assessed by educational level for the total sample. For respondents with less than a high school education, it was .70. For those with a high school diploma or the equivalent, it was .76. Cronbach's alpha was .82 for both respondents with an Associate's degree or a Bachelor's degree. Respondents with a graduate or professional degree had a Cronbach's alpha of .69.

3.5.2.2 Race-Based Medicine Behavioral Orientation

A single item was used to measure RBM behavioral orientation. The purpose of this item was to measure whether or not a respondent would use RBM if it was available. The item used to measure this construct was one of the items developed for the RBM individual-level effectiveness scale: "If coronary artery disease drugs were made for use with different racial groups, I would prefer to use the one designed for my racial group."

3.5.2.3 Race-Based Medicine Population-Level Effectiveness

A single item was used to measure RBM population-level effectiveness. The purpose of this item was to measure the extent to which a respondent believes that RBM would be effective at the population-level by reducing health inequalities. The item used to measure this construct is the following: "Drugs created for different races will reduce health inequalities in the United States." Although this item was intended to measure an underlying construct that was separate and apart from the four items used to measure RBM individual-level effectiveness, a factor analysis was conducted in order to assess the extent to which the RBM population-level

effectiveness item was related to the RBM individual-level effectiveness scale. The factor analysis suggested a one factor solution for all five items, although the RBM population-level effectiveness item's factor loading was on the lower end of the five values. This suggests that the RBM population-level effectiveness item is related to those items used to measure RBM individual-level effectiveness, although the underlying construct measured by this item may be somewhat different from that collectively measured by the other four items.

Notably, the concept of "health inequalities" may not be a concept with which all Americans are familiar, therefore it is possible that the RBM population-level effectiveness item may not have measured what I had intended for it to measure. However, in addition to the factor analysis suggesting that the item is related to the other RBM individual-level effectiveness items used in this study, when this item was added to the RBM individual-level effectiveness scale items in an internal consistency reliability analysis, good reliability was maintained for the sample as a whole, as well as for the white, black and Hispanic sub-samples (Cronbach's alphas were the following: total sample = .78; whites = .79; blacks = .78; and Hispanics = .84). Therefore at the very least, the reliability analysis results suggest that the RBM population-level effectiveness item is reliable at measuring its underlying construct. Once again, I should note that I was limited in the number of items that could be included in the survey and therefore was unable to include additional items related to the construct of RBM population-level effectiveness.

3.5.2.4 Personalized Genomic Medicine Individual-Level Effectiveness

Four items were developed to measure PGM individual-level effectiveness. Each of these items was developed to parallel a corresponding item in the RBM individual-level effectiveness scale. The purpose of developing these items was to measure respondents' beliefs about the effectiveness of PGM at the individual clinical level. The following are the four PGM individual-level effectiveness items that were developed by me with assistance from the Genetics & Stigma Study research team:

(1) "We could do a better job of treating heart disease if drugs were developed based on individuals' genes."

(2) "Medications would work better if they were created based on individuals' genes."

(3) "In my opinion, we should only develop drugs that can be used by everyone regardless of their genetic make-up." (reverse-coded)

(4) "If heart disease drugs were made based on differences between everyone's genes, I would prefer to use the one developed for my gene type."

Because the analyses for Aim 7 of this dissertation study include a comparison of RBM beliefs with PGM beliefs, conceptually and analytically it made sense to keep the same scale structure for PGM individual-level effectiveness as the one developed for RBM individual-level effectiveness. Therefore, a scale comprising all four PGM-related items was constructed to parallel the RBM individual-level effectiveness scale without performing an additional factor analysis of these items. Internal consistency reliability for the PGM individual-level effectiveness scale is good for the total sample and by race. Cronbach's alpha for the total

sample of respondents was .71. For the white respondents, it was .68. For the black respondents, it was .72. An analysis of Cronbach's alpha based on educational level indicated some differences. For respondents with less than a high school education, Cronbach's alpha was .76. For respondent with a high school diploma or the equivalent, it was .59. For respondents with an Associate's degree, it was .78. For those with a Bachelor's degree it was .83. Finally, for respondents with a graduate or professional degree, it was .64.

3.5.2.5 Personalized Genomic Medicine Behavioral Orientation

A single item was used to measure PGM behavioral orientation. The purpose of this item was to measure whether or not respondents would use PGM, if it was available. This item is one of the items developed for the PGM individual-level effectiveness scale and is the following: "If heart disease drugs were made based on differences between everyone's genes, I would prefer to use the one developed for my gene type."

3.5.2.6 RBM-PGM Difference Score

The RBM-PGM individual-level effectiveness difference score and RBM-PGM behavioral orientation difference score were respectively created by subtracting each respondent's PGM individual-level effectiveness belief scale score from his or her RBM individual-level effectiveness belief scale score, and subtracting each respondent's PGM behavioral orientation score from his or her RBM behavioral orientation score. A negative value for either measure indicated that the respondent endorsed RBM at a lower level than PGM,

while a positive value indicated that the respondent endorsed RBM at a higher level than PGM. The greater the absolute value of a difference score, the greater the magnitude of difference in endorsement level between the respective RBM and PGM measures. The intent behind developing these two difference scores was to measure the magnitude and direction of differences in beliefs and attitudes between RBM and PGM for each respondent in the study sample.

3.5.2.7 Item and Scale Validity

Because the items and scales that were developed to measure these constructs are, to my knowledge, the first of their kind, my ability to evaluate the validity of these measures was somewhat limited. Content validity, which according to DeVellis (2003) refers to the extent to which a set of items adequately reflects a content domain, was established by developing multiple items related to the RBM and PGM constructs of interest and submitting these items for review by Professor Phelan's research team, who were all familiar with both RBM and PGM concepts and who had developed varying degrees of expertise in the broader domain of race, genetics and health. Research team members were asked to rate the various items. The items, their ratings and the reasons for why items received the ratings that they did were then discussed by the research team. Highly rated items that received consensus agreement for content validity were the final items included in the survey.

Criterion-related validity, that is, the extent to which items or scales have empirical associations with some "gold standard" measure of the construct of interest, could not be

evaluated because similar or related measures have not previously been developed and established for these constructs (DeVellis, 2003).

Construct validity was also difficult to assess for these new measures. *Known-groups validation* is one way to establish construct validity, which involves demonstrating that theoretically hypothesized differences in fact exist between two or more groups based on their scale scores (DeVellis, 2003). In the case of the RBM-related measures, for example, theoretically we may expect that greater belief in race-related genetic differences would be associated with higher endorsement levels of RBM-related beliefs and attitudes. If whites are more likely than blacks to believe that there are genetic differences between racial groups, then we would expect that whites would be more likely than blacks to endorse RBM beliefs and attitudes. Therefore, construct validity could be established if we could empirically show that whites are more likely to endorse the RBM dependent variables than blacks. This analysis is in fact one that will be used in order to evaluate Hypothesis 1 (see p. 65), which proposes that whites will be more likely to endorse RBM-related beliefs and attitudes than blacks and Hispanics. Although establishing construct validity for these new measures is not one of the aims of this dissertation, the results of the Hypothesis 1 analysis could help to establish construct validity for the RBM measures specifically.

3.5.3 Potential Mediators

3.5.3.1 Genetic Essentialist Beliefs

Genetic essentialist beliefs were measured as an index comprising two items from the *health vignette experiment.* The following are the two items that were used to measure this

construct: (1) “Of the following factors, which do you personally think is the most important in determining a person’s level of intelligence?”; and (2) “Of the following factors, which do you personally think is the most important in determining a person’s general level of health?” The response categories for both items were the following: “Genetic factors”, “A person’s own decisions and actions”, and “Factors in a person’s social environment”. Because the response format for these items were categorical, the responses were dichotomized by valuing “Genetic factors” at 1, with the other response categories made equal to 0. Both items were combined to comprise an index with a value range from 0 to 2. The two items that comprise this index were developed by Jo Phelan and her research team, of which I was a part.

3.5.3.2 Explicit Racist Attitudes

Explicit racist attitudes was measured by collapsing the following three items into a single continuous item that measures warm/cold attitudes towards blacks: “Do you feel warm, cold, or neither warm nor cold to blacks?”, “Do you feel extremely warm, moderately warm or a little warm toward blacks?”, and “Do you feel extremely cold, moderately cold or a little cold toward blacks?” The response categories for the three were collapsed into the following continuum: 1 = “extremely cold”, 2 = “moderately cold”, 3 = “a little cold”, 4 = “neither warm nor cold”, 5= “a little warm”, 6 = “moderately warm”, and 7 = “extremely warm”. These items were administered to the ANES Panel in October 2008 during a previous wave of the panel study, approximately 6 months prior to when data was collected for most of the other items used in this dissertation.

3.5.3.3 Implicit Racist Attitudes

Implicit racist attitudes was measured with the Affect Misattribution Procedure (AMP) (Payne, Cheng, Govorun & Stewart, 2005). The purpose of this measure is to assess the extent to which individuals hold racist attitudes towards African Americans while eliminating any social desirability factors that may modify how respondents answer more explicit items assessing attitudes towards African Americans. The AMP has become an extremely popular tool used to measure implicit social cognition processes, as evidenced by the paper describing the AMP by Payne, Cheng, Govorun & Stewart (2005) having been cited 493 times through December 2013, according to the *Google Scholar*® database. The AMP has been shown to produce strong effects (i.e., $d = 1.25$ – see Cohen (1977/1988) for interpreting effect sizes) as well as exhibit good internal consistency reliability ($.69 < \alpha < .90$) (Payne et al., 2005), and its use in numerous studies with results that seem to be validated by other measures of implicit social cognition processes suggests that it is a valid measure of implicit attitudes. It should be noted, however, that despite the test's popularity, there has been some controversy surrounding whether the procedure adequately measures affect. For example, three studies undertaken by Blaison and colleagues (2012) that used a modified AMP that allowed for assessing both affective and non-affective underlying processes found that in all three studies, the AMP seemed to reflect only non-affective processes.

The AMP was administered online during two previous waves of the ANES study in September and October of 2008. Respondents see photographs of a young male black or white face for 75 milliseconds, followed by a Chinese character for 100 milliseconds, followed by a black and white patterned screen. Respondents then indicate whether they found the Chinese character to be pleasant or unpleasant. Twenty-four trials of black faces were intermixed with 24

trials of white faces. The AMP score is then the percent of characters associated with black faces that were judged to be unpleasant minus the percent of characters associated with white faces that were judged unpleasant. The greater the score, the more a respondent is judged to hold implicit racist attitudes towards African Americans. Cronbach's alpha for whites and Hispanics combined is .85. For whites only, it is .80 and for Hispanics only it is .97.

3.5.3.4 Genetic Essentialist Beliefs in Racial Differences

Genetic essentialist beliefs in racial differences was measured by a single item, which was the following: "There are very few genetic differences among racial groups." The response categories for this item were "strongly disagree" (1), "somewhat disagree" (2), "somewhat agree" (3), and "strongly agree" (4). This item was reversed-coded in order for high scores to reflect endorsement of genetic essentialist beliefs in racial differences.

3.5.4 Potential Moderator

3.5.4.1 Vignette Acceptance

Two items were used as a scale to measure the extent to which respondents accepted the information that was provided in the vignette he or she had received (Cronbach's alpha = .73 for total sample; .65 for whites; .73 for blacks). The two items were:

(1) "In your opinion, the article provided an accurate account of the topics it discussed."

(2) "The article struck you as biased and inaccurate." (reverse-coded)

The response categories for both items were 4 = “strongly agree”, 3 = “somewhat agree”, 2 = “somewhat disagree”, and 1 = “strongly disagree”.

3.5.5 Covariates

For Aims 1-3, which examine racial differences in baseline RBM attitudes and beliefs, I adjusted the multiple regression analyses to control for several socio-demographic variables that are potential confounders. They are the following: sex (male = 1, female = 0); education (1 = “no formal education”, 2 = “1st, 2nd, 3rd or 4th grade”, 3 = “5th or 6th grade”, 4 = “7th or 8th grade”, 5 = “9th grade”, 6 = “10th grade”, 7 = “11th grade”, 8 = “12th grade No Diploma”, 9 = “High school graduate—high school diploma or the equivalent”, 10 = “Some college, no degree”, 11 = “Associate degree”, 12 = “Bachelor’s degree”, 13 = “Masters degree”, 14 = “Professional or doctorate degree”); age (in years); and geographic region in which the respondent resided (dummy variables were created for the following regions: Northeast, Midwest, South, Southeast, Rocky Mountain/Southwest, and West). Prior qualitative studies that examined racial differences in RBM-related beliefs and attitudes were concentrated in the Southeast region of the U.S. Therefore, Southeast was set as the referent category for the geographic region dummy variables in order to see if people from other regions in the U.S. significantly differed in their RBM-related beliefs and attitudes than those from this region that was previously examined.

For the multiple regression analyses in Aims 4-5, which examine the *race vignette experiment’s* effect on RBM attitudes and beliefs, confounding should not be an issue since the vignettes were randomly assigned. However, in order to increase the precision of the estimates of the vignettes’ effects on RBM attitudes and beliefs, and to assess the generality of the effects

of the vignettes across sex, education and age, I controlled for these socio-demographic variables as well. For these aims, I also controlled for white versus black race. In this case, 1 = black and 0 = white.

In the multiple regression analysis for Aim 6, I controlled for sex, education, age, and geographic region in order to avoid potential confounding. I additionally controlled for type of *race vignette* received. Although the vignettes are about race and genetics and none mention PGM, the discussion of genetics alone could potentially have some influence on beliefs about PGM, thereby necessitating adjustments of the analyses for *race vignette* received.

3.5.6 Missing Values

Tables 3.4 and 3.5 present the number and proportions of missing values for each of the variables used for Aims 1-3 and Aims 4-7 respectively. Many of the variables had no missing values while some had anywhere from 0.1 to 4.3 percent missing values. The only variable with more than 4.3 percent missing values was implicit racist attitude (measured by the AMP), which had 9.9 percent of its values missing. Because of the large proportion of values missing for this variable, the mean AMP value was substituted for missing values in order to minimize the number of cases dropped from the related analyses. There were relatively low proportions of missing values for the remaining variables used in the dissertation's analyses. Thus, cases with missing values for variables other than implicit racist attitude were ignored and dropped from the analyses.

Table 3.4: Proportion of missing values for each item, scale and index used in the Part 1 analyses for Aims 1-3.

Variables	n	Total Values	Missing Values	% Missing
Race	411	411	0	0.0
Sex	411	411	0	0.0
Age	411	411	0	0.0
Education	411	407	4	1.0
Geographic Region	411	411	0	0.0
RBM Individual-Level Effectiveness Scale	411	403	8	1.9
RBM Item 1 - RBM treats heart disease	411	403	8	1.9
RBM Item 2 - RBM medications work better	411	403	8	1.9
RBM Item 3 - Everyone should use the same drugs regardless of race	411	404	7	1.7
RBM Behavioral Orientation – RBM Item 4 - I prefer to use RBM	411	403	8	1.9
RBM population-level effectiveness – RBM Item 5	411	403	8	1.9
Genetic Essentialist Beliefs Index	411	396	15	3.7
Genetic Essentialist Beliefs Item 1 - Genes are the most important cause of health	411	401	10	2.4
Genetic Essentialist Beliefs Item 2 - Genes are the most important cause of intelligence	411	404	7	1.7
Implicit Racist Attitude	365	329	36	9.9
Explicit Racist Attitude	365	347	18	4.3

Table 3.5: Proportion of missing values for items and scales used in Parts' 2 and 3's analyses for Aims 4-7.

Variables	n	Total Values	Missing Values	% Missing
Race	632	632	0	0.0
Sex	632	632	0	0.0
Age	632	632	0	0.0
Education	632	631	1	0.1
Geographic Region	632	632	0	0.0
Vignette Received	632	632	0	0.0
Genetic Essentialist Beliefs in Racial Differences	632	621	11	1.7
Vignette Acceptance Scale	547	547	0	0.0
Vignette Acceptance Item 1	547	547	0	0.0
Vignette Acceptance Item 2	547	547	0	0.0
RBM Individual-Level Effectiveness Scale	632	630	2	0.3
RBM Item 1 - RBM treats heart disease	632	630	2	0.3
RBM Item 2 - RBM medications work better	632	628	4	0.6
RBM Item 3 - Everyone should use the same drugs regardless of race	632	630	2	0.3
RBM Behavioral Orientation – RBM Item 4 - I prefer to use RBM	632	625	7	1.1
RBM Population-level Effectiveness – RBM Item 5	632	626	6	0.9
PGM Individual-level Effectiveness Scale	632	632	0	0.0
PGM Item 1 – PGM treats heart disease	632	632	0	0.0

Table 3.5: Proportion of missing values for items and scales used in Parts' 2 and 3's analyses for Aims 4-7.

Variables	n	Total Values	Missing Values	% Missing
PGM Item 2 – PGM medications work better	632	632	0	0.0
PGM Item 3 – everyone should use same drugs regardless of genetic make-up	632	632	0	0.0
PGM Behavioral Orientation - PGM Item 4 – I prefer to use PM	632	632	0	0.0

3.6 Analyses

SPSS Version 21.0's Complex Sampling Module was used to perform the data analysis in order to estimate the correct standard errors for the telephone survey data, which has a complex survey design. Depending on the aim, I used frequencies, crosstabulation and multiple linear regression analyses to assess each specific aim. Results were weighted to account for under- and over-sampling of different households. The data were also adjusted for any non-response or non-coverage that resulted from the sample design. The following summarizes my general strategy for the analyses of the dissertation's aims.

Analysis of Aim 1. In order to assess whether racial groups differed in their beliefs about RBM individual-level effectiveness, behavioral orientation and population-level effectiveness, I conducted frequencies and multiple linear regression analyses. In the regression analyses, each of the RBM-related dependent variables was regressed on the race dummy variables and socio-demographic control variables. Multiple linear regression was also used to examine if there were interaction effects between race and most of the socio-demographic control variables (sex,

education, age), in order to assess the extent to which the differences between racial groups were modified by other social characteristics. First, R^2-change was assessed to see if the set of tested interactions as a group had a significant effect on each of the RBM dependent variables. Those dependent variables for which R^2-change was significant had the individual interaction terms examined to assess potential racial differences in the associations between the socio-demographic variables and the dependent variable of interest. The RBM dependent variables for which interaction effects were found then underwent race-specific multiple linear regression analyses in order to examine how each of the socio-demographic control variables may be differentially related to the dependent variables for each racial group. These analyses are discussed in detail in the methods section of Chapter 4 (pp. 127-131).

Analysis of Aim 2. For this aim, I used multiple linear regression to examine whether there are racial differences in genetic essentialist beliefs, a potential mediator between race and RBM individual-level effectiveness, behavioral orientation and/or population-level effectiveness. Genetic essentialist beliefs was regressed on the race dummy variables, as well as the socio-demographic control variables, in order to examine whether white respondents differ from black and Hispanic respondents on this construct. Genetic essentialist beliefs was then tested as a mediator between RBM individual-level effectiveness, behavioral orientation and/or population-level effectiveness and race. *Genetic essentialist belief was only tested as a mediator for those dependent variables for which statistically significant racial differences were found in Aim 1*. I followed Baron and Kenny's (1986) steps for testing mediation effects. These analyses are discussed in greater detail in the methods section of Chapter 4 (pp. 127-131).

Analysis of Aim 3. In this aim, I separately tested implicit racist attitudes and explicit racist attitudes as mediators between race and the RBM-related dependent variables. *Both*

attitudinal constructs were only tested as mediators between the white and Hispanic respondents and both were only tested for the dependent variables that were endorsed by whites at greater levels than blacks and Hispanics in Aim 1. Once again, I followed Baron and Kenny's (1986) steps for testing mediation effects.

Analysis of Aim 4. In this aim, I assessed whether vignettes in the form of mock news articles that discuss different types of relationships between race and genes impact RBM beliefs and attitudes. I analyzed this aim in three parts. First, I examined the means for RBM individual-level effectiveness, behavioral orientation and population-level effectiveness by vignette arm in order to assess the extent to which the vignettes' may have affected the dependent variables.

Second, I calculated R^2-change to examine the overall impact of the vignette experiment on the RBM-related dependent variables in comparison to a model that only examined the impact of socio-demographic variables on the dependent variables. How R^2-change is calculated is discussed in further detail in the methods section of Chapter 5 (pp. 171-176).

Third, if the change in R^2 indicated that the vignettes had an overall effect on RBM beliefs and attitudes, then hypotheses 4a-4e, which test for individual vignettes' effects on the dependent variables, were tested. These hypotheses were tested using multiple linear regression. The different models constructed to test each hypothesis are discussed in the methods section of Chapter 5 (pp. 171-176).

Analysis of Aim 5. In this aim, I assessed whether acceptance of the vignette modified the effect of the vignette received on RBM individual-level effectiveness, behavioral orientation and population-level effectiveness. Potential interaction effects between vignette received and

acceptance of the vignette's information were assessed using multiple linear regression. Further details regarding Aim 5's analysis are discussed in the Chapter 5 methods section (pp. 171-176).

Analysis of Aim 6. For aim 6, I assessed whether there are racial differences in beliefs about PGM individual-level effectiveness and behavioral orientation. Means were calculated, frequencies were examined and multiple linear regression was used to examine whether there are racial differences in PGM individual-level effectiveness and behavioral orientation beliefs and attitudes. These analyses are further discussed in the Chapter 6 methods section (pp. 252-256).

Analysis of Aim 7. The purpose of this aim is to compare PGM individual-level effectiveness and behavioral orientation beliefs and attitudes with RBM individual-level effectiveness and behavioral orientation beliefs and attitudes. For this aim, I compared mean PGM individual-level effectiveness and behavioral orientation scores with mean RBM individual-level effectiveness and behavioral orientation scores for the sample as a whole, as well as for the white and black sub-samples. This was done by comparing means and frequencies for PGM individual-level effectiveness and behavioral orientation scores with those for RBM individual-level effectiveness and behavioral orientation scores. These analyses were stratified by *race vignette experiment* condition. A crosstabulation analysis among the respondents was also conducted between PGM and RBM individual-level effectiveness as well as PGM and RBM behavioral orientation, stratified by vignette condition and race.

Student's *t*-tests were conducted to assess whether the mean RBM-PGM individual-level effectiveness and behavioral orientation difference scores significantly differed from zero. The Student's *t*-tests were separately conducted for each *race vignette experiment* condition in an effort to adjust for the potential effects of the vignettes on RBM- and PGM-related beliefs and

attitudes. In addition, *t*-tests were separately conducted by race in order to assess potential differences between white and black respondents for the RBM-PGM difference scores by vignette condition. Both the RBM-PGM individual-level effectiveness and RBM-PGM behavioral orientation difference scores were regressed on race, adjusting for socio-demographic variables and the *race vignette experiment*. In order to assess whether the *race vignette experiment* had differential effects on whites and blacks in the magnitude, and possibly, direction of respondents' difference scores, RBM-PGM individual-level effectiveness and behavioral orientation difference scores were also separately regressed on race by *race vignette* interaction terms, adjusting for socio-demographic variables.

3.7 Power

Power calculations were made for Student's *t*-tests, ANOVA, and multiple linear regression using power estimates obtained from tables developed by Cohen (1977/1988). The main approach to most analyses undertaken for this dissertation study is multiple linear regression. As such, I will provide evidence for most tested hypotheses using that approach. However, in certain instances, particularly those concerning comparisons by racial groups, the multiple linear regression power analyses do not adequately reflect the imbalance in the size of the racial groups, as well as the *race vignette experiment* conditions, examined in this study. Multiple regression power calculations are based on increments of explained variance. While such calculations are valid, they do not capture the importance of group size. In order to give some indication of power that does reflect group size, I have conducted power analyses for Student's *t*-tests and ANOVAs when necessary because these calculations account for group size

and provide a way to address group size imbalance when calculating power. These power analyses will provide evidence as to which tests are likely to have more power, and which less, given group size and imbalance between groups. Although calculating power estimates for Student's *t*-tests or ANOVAs in lieu of multiple linear regression power estimates may overestimate the power of some of the multiple linear regression models (since such power calculations do not account for the inclusion of additional control variables), the extent to which power is affected by vast sample size difference between groups is likely better accounted for in mean-difference power estimates than multiple linear regression power estimates. Student's *t*-test and ANOVA power estimates for multiple linear regression models are intended to approximate the extent to which the sample size for each racial group or each vignette condition was sufficient for finding small, medium and large effect sizes (see Cohen (1988) pp. 8-14, for a discussion on how to meaningfully interpret effect sizes). Because group comparisons are central to many tests undertaken in this dissertation study, using *t*-test and ANOVA power calculations to assess relative power for some of the multiple linear regression analyses enables one to assess those instances in which power is relatively better, or relatively worse, given the data that I am working with to answer this dissertation study's research questions.

Tables 3.6 through 3.12 provide the power estimates by Aim for each Student's *t*-test, ANOVA or multiple linear regression power calculation conducted for that particular Aim. All analyses are based on a significance criterion alpha level of .05. I will follow the conventional definition of sufficient power to detect an effect size as 80 or higher. The alpha level for the Student's *t*-tests is based on a two-tailed model. Cohen's (1977/1988) power tables for a two-tailed *t*-test that compares the means of two different groups is based on the following formula:

$$\mathbf{d} = \left| \frac{\mathbf{m_A - m_B}}{\boldsymbol{\sigma}} \right|$$

In this formula, **d** represents effect size and follows conventional effect size definitions for *t*-tests as stated by Cohen:

small: **d** = .20

medium: **d** = .50

large: **d** = .80

$\mathbf{m_A}$ and $\mathbf{m_B}$ represent the respective means of groups A and B and **σ** represents the standard deviation of both samples. Cohen's power tables for *t*-tests require one to know all of the following in order to calculate power: sample size (**n**), effect size (**d**) and significance level (**a**), including whether a one- or two-tailed test will be done. When the means of groups' A and B are compared and the sample sizes of the two groups are unequal, a weighted mean sample size (**n'**) between the two groups is used instead of **n** in order to calculate power. **n'** was calculated using the following formula:

$$\mathbf{n' = \frac{2n_A n_B}{n_A + n_B}}$$

The ANOVA power calculation's primary effect size index is **f**, which is defined as the standard deviation of **k** number of standardized population means (**k** in this case represents the number of group means that are compared in an ANOVA analysis). **f** is related to **d** by the following formula:

$$\mathbf{d} = 2\mathbf{f}$$

d in this case is similar to the **d** used to assess effect size in the Student's *t*-test power calculation, however in the case of ANOVA, it represents the range of standardized means, meaning, the distance between the smallest and largest of the **k** means:

$$\mathbf{d} = \frac{\mathbf{m}_{max} - \mathbf{m}_{min}}{\boldsymbol{\sigma}}$$

Cohen notes that the values for effect size **f** are conventionally defined as the following:

Small: **f** = .10

Medium: **f** = .25

Large: **f** = .40

In order to assess the statistical power of an ANOVA analysis, **F** test power tables were used. The following are required in order to calculate an ANOVA power analysis: sample size (**n**), effect size (**f**), significance level (**a**), and degrees of freedom of the numerator of the **F** ratio (**u,** calculated as equal to **k** – 1).

Some of the multiple linear regression models used in this dissertation study were not primarily focused on comparing two or more groups of substantially unequal sample sizes. In those cases, multiple regression power analyses following Cohen's criteria and formulas for such analyses were appropriate. Cohen notes that for the *t*-test and ANOVA power tables, the appropriate effect size index and sample size are sufficient to determine power of the analysis, however, in order to determine power for a multiple regression analysis, the noncentrality parameter of the noncentral **F** distribution, **λ**, must be used. **λ** is a function of the effect size index as well as the **F** ratio numerator and denominator degrees of freedom, otherwise known as **u** and

v. **u** is set as the number of independent variables in the analysis and **v** is calculated as **n – u –** 1. In order to calculate **λ**, the following formula was used:

$$\lambda = f^2(u + v + 1)$$

According to Cohen, conventional definitions for multiple regression power analysis effect size are the following:

Small: $f^2 = .02$

Medium: $f^2 = .15$

Large: $f^2 = .35$

In order to estimate multiple regression power, the following must be known: numerator degrees of freedom (**u**), denominator degrees of freedom (**v**), the noncentrality parameter of the noncentral **F** distribution (**λ**), and the significance level (**a**).

Tables 3.6-3.8 present the power analysis results for Aims 1-3 respectively. The results indicate that for Aim 1's multiple linear regression analyses examining potential racial differences in RBM beliefs and attitudes (Models 1-6) that the power is good for detecting medium to large effect sizes (99). Models 7-9, which are the race-specific models examining potential associations between certain socio-demographic variables and RBM beliefs and attitudes, show that power is good for detecting medium to large effects amongst the white sub-sample, but not the black and Hispanic sub-samples. Power calculation results for Aim 2's examination of genetic essentialist beliefs as a potential mediator between race and RBM beliefs and attitudes also indicates that power is good for detecting medium to large effects. The power calculation results for Aim 3 indicate that there is only enough power to detect large effect sizes

for the analyses examining implicit and explicit racist attitudes towards African Americans as a possible mediator between race/ethnicity (whites versus Hispanics) and RBM beliefs and attitudes.

Table 3.6: Power calculation analyses for Aim 1 multiple linear regression analyses.

ANOVA power calculations used to assess power for multiple linear regression models examining racial differences in RBM beliefs and attitudes (n_{whites} = 336, n_{blacks} = 46, $n_{Hispanics}$ = 29).

Model No.	n	No. of Groups	Alpha Level	Power for f_{small} = .10	Power for f_{medium} = .25	Power for f_{large} = .40
Models 1-6	411	3	.05	43	99	99

Multiple linear regression power calculations used to assess power for race-specific models of RBM beliefs and attitudes regressed on socio-demographic variables.

Model No.	n	No. of Independent Variables	Alpha Level	Power for f^2_{small} = .02	Power for f^2_{medium} = .15	Power for f^2_{large} = .35
Model 7 (whites)	336	8	.05	41	99	99
Model 8 (blacks)	46	8	.05	5	36	74
Model 9 (Hispanics)	29	8	.05	3	20	44

Table 3.7: Power calculation analyses for Aim 2 multiple linear regression analyses.

ANOVA power calculations used to assess power for multiple linear regression models examining genetic essentialist beliefs as a mediator between race and race-based medicine beliefs and attitudes (n_{whites} = 336, n_{blacks} = 46, $n_{Hispanics}$ = 29).

Model No.	n	No. of Groups	Alpha Level	Power for f_{small} = .10	Power for f_{medium} = .25	Power for f_{large} = .40
Models 10-12	411	3	.05	43	99	99

Table 3.8: Power calculation analyses for Aim 3 multiple linear regression analyses.

Student's *t*-test power calculations used to assess power for multiple linear regression models examining implicit and explicit racist attitudes as a mediator between race/ethnicity and race-based medicine beliefs and attitudes

(n_{whites} = 336, $n_{Hispanics}$ = 29).

Model No.	n	n'	Alpha Level	Power for d_{small} = .20	Power for d_{medium} = .50	Power for d_{large} = .80
Models 13-15	365	53	.05	18	72	98

Table 3.9 presents the power analyses results for Aim 4. The results show that the power for testing possible racial differences in RBM beliefs and attitudes by *race vignette* condition is borderline adequate to good (67-89) for large effect sizes depending on the vignette condition to which respondents were assigned. However, it should be noted that the vignette condition with the lowest power for detecting racial differences is the no-vignette control condition (Model 20), which is a replication of the analyses for detecting racial differences in RBM beliefs and attitudes examined in Aim 1 (models 1-6); as previously noted, the power for those models was sufficient for detecting medium to large effects. Table 3.9 results also show that the power is good for detecting medium to large effect sizes in the analysis that examines the *race vignette experiment's* overall effect on RBM beliefs and attitudes (Model 21), as well as for testing genetic essentialist beliefs in racial differences as a mediator of the *race vignette experiment's* effect on RBM beliefs and attitudes (Model 22). The power for models 23-27, which directly compare the effects of different vignette conditions on RBM beliefs and attitudes, is sufficient for detecting medium to large effect sizes.

Table 3.10 presents the power calculation results for Aim 5, which examines acceptance of the vignette message as a possible moderator between vignette received and RBM beliefs and attitudes. The results show that power is good for detecting medium to large effect sizes for the *race vignette experiment's* overall effect on the vignette acceptance scale. Multiple linear regression models that examine the association between the vignette acceptance scale and RBM beliefs and attitudes by *race vignette* condition indicate that power is good for detecting medium to large effect sizes for all vignette conditions. The results also show that the power is good for detecting medium to large effect sizes in the models examining the vignette acceptance scale as a moderator between *race vignette* condition and RBM beliefs and attitudes.

Table 3.9: Power calculation table for Aim 4 multiple linear regression analyses.

Student's *t*-test power calculations used to assess power for multiple linear regression models examining racial differences in race-based medicine beliefs and attitudes by *race vignette* condition.

Model No.	n	n'	Alpha Level	Power for d_{small} = .20	Power for d_{medium} = .50	Power for d_{large} = .80
Model 16 *Race Is Genetic* Vignette (N_{whites} = 114, N_{blacks} = 19)	133	33	.05	13	51	89
Model 17 *Genetic Health Difference* Vignette (N_{whites} = 143, N_{blacks} = 16)	159	29	.05	12	46	85
Model 18 *Admixture* Vignette (N_{whites} = 108, N_{blacks} = 13)	121	23	.05	10	39	77
Model 19 *Social Construction* Vignette (N_{whites} = 114, N_{blacks} = 19)	133	33	.05	13	51	89
Model 20 No-Vignette Control (N_{whites} = 74, N_{blacks} = 11)	85	19	.05	9	32	67

Table 3.9: Power calculation table for Aim 4 multiple linear regression analyses.

ANOVA power calculations used to assess power for multiple linear regression models examining the overall effect of the *race vignette experiment* on race-based medicine beliefs and attitudes.

Model No.	n	No. of Groups	Alpha Level	Power for f_{small} = .10	Power for f_{medium} = .25	Power for f_{large} = .40
Model 21 *Race Vignette Experiment's* Overall Effect on RBM Beliefs and Attitudes	632	5	.05	49	99	99

Multiple linear regression power calculations used to assess power for testing genetic essentialist beliefs in racial differences as mediator between the *race vignette experiment* and race-based medicine beliefs and attitudes.

Model No.	n	No. of Independent Variables	Alpha Level	Power for f^2_{small} = .02	Power for f^2_{medium} = .15	Power for f^2_{large} = .35
Model 22	632	9	.05	64	99	99

Table 3.9: Power calculation table for Aim 4 multiple linear regression analyses.

Student's *t*-test power calculation used to assess power for multiple linear regression models examining differences in the effects of specific *race vignette* conditions on race-based medicine beliefs and attitudes.

Model No.	n	n'	Alpha Level	Power for d_{small} = .20	Power for d_{medium} = .50	Power for d_{large} = .80
Model 23 Hypothesis 4a: *Race Is Genetic* v. *Genetic Health Difference*	292	145	.05	39	99	99

Student's *t*-test power calculation used to assess power for multiple linear regression models examining differences in the effects of specific *race vignette* conditions on race-based medicine beliefs and attitudes.

Model No.	n	n'	Alpha Level	Power for d_{small} = .20	Power for d_{medium} = .50	Power for d_{large} = .80
Model 25 Hypothesis 4c: *Social Construction* v. No-Vignette Control	218	104	.05	30	99	99

Table 3.9: Power calculation table for Aim 4 multiple linear regression analyses.

ANOVA power calculations used to assess power for multiple linear regression models examining the effects of specific *race vignette* conditions on race-based medicine beliefs and attitudes.

Model No.	n	No. of Groups	Alpha Level	Power for $f_{small} = .10$	Power for $f_{medium} = .25$	Power for $f_{large} = .40$
Model 24 Hypothesis 4b: *Race Is Genetic* v. *Genetic Health Difference* v. *Admixture*	413	3	.05	47	99	99
Model 26 Hypothesis 4d: *Social Construction* v. No-Vignette Control v. *Admixture*	339	3	.05	36	99	99
Model 27 Hypothesis 4e: *Race Is Genetic* v. *Genetic Health Difference* v. *Social Construction* v. No-Vignette Control	510	4	.05	45	99	99

Table 3.10: Power calculation table for Aim 5 multiple linear regression analyses.

ANOVA power calculation used to assess power for multiple linear regression model examining the effects of the *race vignette experiment* on the vignette acceptance scale.

Model No.	n	No. of Groups	Alpha Level	Power for f_{small} = .10	Power for f_{medium} = .25	Power for f_{large} = .40
Model 28 *Race Vignette Experiment's* Overall Effect on Vignette Acceptance Scale	631	5	.05	49	99	99

Multiple linear regression power calculation used to assess power for race-based medicine beliefs and attitudes regressed on the vignette acceptance scale, by *race vignette* condition.

Model No.	n	No. of Independent Variables	Alpha Level	Power for f^2_{small} = .02	Power for f^2_{medium} = .15	Power for f^2_{large} = .35
Model 29 *Race Is Genetic*	133	5	.05	17	95	99
Model 30 *Social Construction*	133	5	.05	17	95	99
Model 31 *Admixture*	121	5	.05	19	91	99
Model 32 *Genetic Health Difference*	159	5	.05	24	98	99

Table 3.10: Power calculation table for Aim 5 multiple linear regression analyses.

Student's *t*-test power calculation used to assess power for multiple linear regression models comparing *race vignette* conditions' effects, moderated by the vignette acceptance scale, on race-based medicine beliefs and attitudes.

Model No.	n	n'	Alpha Level	Power for d_{small} = .20	Power for d_{medium} = .50	Power for d_{large} = .80
Model 33 Hypothesis 5a: *Race Is Genetic* v. *Social Construction*	266	133	.05	36	99	99
Model 34 Hypothesis 5b: *Race Is Genetic* v. *Genetic Health Difference*	292	145	.05	39	99	99
Model 35 Hypothesis 5c: *Race Is Genetic* v. *Admixture*	253	127	.05	35	98	99

Table 3.11 presents the power results for Aim 6's multiple linear regression models that examine potential racial differences in PGM beliefs and attitudes. The results indicate that power is good for detecting medium to large effect sizes in PGM beliefs and attitudes between the white and black respondents (Models 36-37). Power is also good for detecting medium to large effect sizes in PGM beliefs and attitudes among the white sub-sample (Model 38) but is only good for detecting a large effect size among the black sub-sample (Model 39). Table 3.12 presents the power calculation results for Aim 7. The results indicate that power is excellent for

detecting anything from a small to a large effect in the Student's *t*-test analysis that examines whether the magnitude of difference between RBM and PGM beliefs and attitudes significantly differs from 0 (Model 40). The results also indicate that the power is good for detecting medium to large effect sizes in the multiple linear regression models (Models 41-42) that examine potential racial differences in the *race vignette experiment's* overall effect on the magnitude of difference between RBM and PGM beliefs and attitudes.

Table 3.11: Power calculation table for Aim 6 multiple linear regression analyses.

Student's *t*-test power calculation used to assess power for multiple linear regression model examining racial differences in personalized genomic medicine beliefs and attitudes (n_{whites} = 553, n_{blacks} = 79).

Model No.	n	n'	Alpha Level	Power for d_{small} = .20	Power for d_{medium} = .50	Power for d_{large} = .80
Models 36-37	632	139	.05	38	99	99

Multiple linear regression power calculation used to assess power for personalized genomic medicine beliefs and attitudes regressed on socio-demographic control variables and *race vignette experiment,* by race.

Model No.	n	No. of Independent Variables	Alpha Level	Power for f^2_{small} = .02	Power for f^2_{medium} = .15	Power for f^2_{large} = .35
Model 38 (Whites only)	553	12	.05	56	99	99
Model 39 (Blacks only)	79	12	.05	8	52	94

Table 3.12: Power calculation table for Aim 7 Student's *t*-tests, ANOVA and multiple linear regression analyses.

Student's *t*-test power calculation used to assess whether the race-based medicine-personalized genomic medicine difference scores for individual-level effectiveness and behavioral orientation differ from 0.

Model No.	n	Alpha Level	Power for d_{small} = .20	Power for d_{medium} = .50	Power for d_{large} = .80
Model 40 RBM-PGM Individual-Level Effectiveness/Behavioral Orientation Difference Scores	632	.05	99	99	99

Student's *t*-test power calculation used to assess power for multiple linear regression model examining racial differences in race-based medicine-personalized genomic medicine difference scores for individual-level effectiveness and behavioral orientation for the *race vignette experiment* overall.

Model No.	n	n'	Alpha Level	Power for d_{small} = .20	Power for d_{medium} = .50	Power for d_{large} = .80
Models 41-42 *Race Vignette Experiment* (N_{whites} = 553, N_{blacks} = 79)	632	139	.05	38	99	99

In sum, most of the analyses have sufficiently large enough sample sizes to detect medium to large effect sizes. In nearly all cases, however, small effect sizes may not be detected. Because this dissertation study was part of the larger Genetics & Stigma Study, the overall design of the parent study had sample size needs that were different from this dissertation study. Despite some of the power limitations of the analyses conducted for this dissertation study, the results, nonetheless, will provide new insight into the lay public's conceptions regarding RBM and PGM, as this is the first nationally representative study to examine such conceptions. Because most of the analyses in this study do have the power to detect medium to large effect sizes should they exist, this study's findings will still provide significant insight into the relationship between self-identified race/ethnicity and RBM- and PGM-related beliefs and attitudes. Although it would be ideal to have the ability to detect small effect sizes should they exist, Cohen notes that the concept of effect size is relative to the research questions at hand and requires some reflexive thought as to what extent different effect sizes provide meaningful evidence for conclusions made from the results. Is a small difference between whites, blacks and Hispanics in RBM- or PGM-related beliefs and attitudes much more alarming than no difference at all? This is a question that requires further thought from various stakeholders in the debates surrounding the development and administration of RBM and PGM. The detection of large, or even medium effect sizes, however, certainly would make interested parties pause to further consider the merits or concerns surrounding the implementation of RBM and PGM. For this reason, the findings from this study - particularly those that are statistically significant as they would generally suggest a medium to large difference between the groups in question - will provide stakeholders with important information that should be considered as efforts continue to develop RBM and PGM.

Chapter 4:

PART 1: RACE-BASED MEDICINE BELIEFS AND ATTITUDES

4.1 Introduction:

To date, there has been little research examining lay beliefs and attitudes towards race-based medicine (RBM). The research that is available suggests that beliefs about the effectiveness of RBM specifically differ by individuals' racial or ethnic background (Bevan, Lynch, Dubriwny, Harris, Achter, et al., 2003; Condit, Templeton, Bates, Bevan & Harris, 2003; Marco, 2010). To the extent that the development and promotion of RBM is meant to improve the delivery of and clinical response to medical care for racial and ethnic populations that have been traditionally burdened with poorer health outcomes, then better understanding whether the race or ethnicity of patients affects beliefs and attitudes about RBM – and more importantly, behavioral orientation towards using RBM – becomes critical for healthcare planning and policy purposes.

In order to better understand beliefs and attitudes towards RBM, in particular whether race is associated with these beliefs and attitudes, this chapter will focus on three of this dissertation study's aims.

Aim 1. For Aim 1, I will examine whether racial groups differ in terms of beliefs about RBM's individual-level effectiveness, behavioral orientation towards using RBM, and RBM's population-level effectiveness. Previous research has found that blacks and Hispanics were more "suspicious" about RBM than whites for a variety of reasons, including concerns that RBM would be less effective than other types of treatments (Bevan et al., 2003; Condit et al., 2003;

Marco, 2010). Therefore, I expect to find that whites are more likely than blacks and Hispanics to endorse RBM effectiveness beliefs and preferences for using RBM. The hypothesis for this aim is the following:

> ***Hypothesis 1***: Whites are more likely than blacks and Hispanics to endorse beliefs relating to and attitudes towards RBM individual-level effectiveness, behavioral orientation and population-level effectiveness.

Aims 2 and 3 are contingency aims that will only be examined for those RBM dependent variables for which racial differences are found in Aim 1. These aims look at two different potential mediators of racial differences in RBM-related beliefs and attitudes.

Aim 2. If racial differences are found in Aim 1, Aim 2 will examine whether genetic essentialist beliefs explain any differences between racial groups in RBM-related individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes. I expect to find that genetic essentialist beliefs partially mediate an association between race and the RBM-related dependent variables, meaning, racial differences in RBM beliefs and attitudes are attributable in part to differences in genetic essentialist beliefs. The theoretical foundation for this hypothesis is that people in socially privileged positions are more likely to endorse genetic essentialist beliefs in order to justify existing social hierarchies (Jayaratne et al., 2006; Nelkin & Lindee, 1995). The assumption here is that whites would be more likely to endorse genetic essentialist beliefs and that genetic essentialist beliefs would be positively associated with RBM beliefs and attitudes.

> ***Hypothesis 2***: Genetic essentialist beliefs partially mediate the association between race and RBM individual-level effectiveness belief, behavioral orientation and population-

level effectiveness belief. Endorsement of genetic essentialist beliefs will be associated with endorsement of the three aforementioned RBM-related dependent variables.

Aim 3. Finally, if whites are found to endorse RBM-related individual-level effectiveness, behavioral orientation and/or population-level effectiveness beliefs and attitudes at greater levels than blacks and Hispanics in Aim 1, then Aim 3 will examine whether implicit racist attitudes and explicit racist attitudes towards African Americans explain some of the differences in these beliefs and attitudes between whites and Hispanics. I expect to find that whites compared with Hispanics will hold more racist attitudes towards African Americans, and that these attitudes will be associated with greater endorsement of RBM's effectiveness and preferences for using RBM. Previous research has shown that whites hold more racist attitudes than Hispanics towards African Americans (Hunt, 2007). There is also some evidence that has linked racist attitudes with beliefs in biological/essential racial differences (Kinder & Sanders, 1996; Keller, 2005; Jayaratne et al., 2006). In turn, belief in biological and essential racial differences may be associated with greater endorsement of RBM's effectiveness and preferences for using it among those who assume that race-specific differences in the efficacy of biomedical treatments are due to biological differences between racial groups. Aim 3's hypotheses are in two parts:

Hypothesis 3a: Implicit racist attitudes and explicit racist attitudes towards African Americans will be associated with endorsement of RBM-related individual-level effectiveness, behavioral orientation and population-level effectiveness.

Hypothesis 3b: Implicit racist attitudes and explicit racist attitudes will mediate the relationship between race and RBM-related individual-level effectiveness, behavioral orientation and population-level effectiveness.

Hypothesis 3b will only be tested if the analysis for Hypothesis 3a indicates an association between implicit racist attitudes and/or explicit racist attitudes and the dependent variable that is being tested.

Note, a summary of Aims 1-3 and the rest of study's aims, plus each aim's hypotheses, can be found in Table 3.3 (p. 75).

4.2 Research Design and Methods:

4.2.1 Sample

The sample for Aims 1 and 2 are the 411 self-identified white, black and Hispanic respondents who were randomized to the control arm of the *health vignette experiment* (see p. 55 in Chapter 3 for a description of this experiment). The sample for Aim 3 is comprised of only the white and Hispanic respondents who were included in the Aims 1 and 2 sample (n = 365).

Demographic characteristics for the sample used for Aims 1-3 are compared with 2010 U.S. Census Data in Table 4.1 (U.S. Census Bureau, 2013). Correspondence with the Census was good for sex, education and age, however, the sample had a smaller proportion of Hispanic respondents and a higher proportion of white respondents. Hispanic ethnicity was measured separately from race in the Census but not in this survey, so it is possible that a portion of the non-Hispanic respondents would have reported Hispanic ethnicity in addition to their race if given the chance. 2010 Census results in fact show that 91.6 percent of people who identified as Hispanic or Latino, racially identified as only white (Humes, Jones and Ramirez, 2011). All analyses, however, are adjusted to account for potential sampling bias.

Table 4.1: Comparison of selected characteristics of Aims 1-3 sample (n = 411) with 2010 United States Census data for individuals 18 or older.

	n	%	2010 Census %
Race			
White	336	81.8	72.4[a]
Black	46	11.2	12.6
Hispanic	29	7.1	16.3
Male	192	46.7	49.2
Age			
18-44	175	42.5	48.1
45 to 64	156	38.1	34.2
65 and older	80	19.4	17.2
Educational attainment among those 25 or older[b]			
<HS	30	8.2	12.9
HS	187	50.8	48.1
Associate's degree	31	8.4	9.1
Bachelor's degree	79	21.5	19.4
Graduate degree	41	11.1	10.5

[a] Hispanic ethnicity is measured separately from race in the Census.
[b] The Census only reports educational attainment for individuals aged 25 and older.

Table 4.2 is a comparison of selected characteristics of the sample by race/ethnicity. An analysis of the three race-specific samples shows that each group has more female than male respondents. The Hispanic group has a greater proportion of female respondents compared to the white and black sub-samples. A chi-square analysis, however, showed that there was no significant difference between racial groups in the proportion of male versus female respondents. With respect to age, the white sub-sample was somewhat older compared to the black and Hispanic sub-samples. The Hispanic sub-sample had no participants aged 65 or older. The lack of older Hispanic Americans in this sample may be due to a high proportion of older Hispanic Americans whose primary language is not English, and who therefore were unable to participate in an English-only survey. An ANOVA was conducted assessing the relationship between race and age and notably, there is no statistically significant difference between the three racial groups for age (p = .075).

The ANOVA comparing the three racial groups on educational attainment among sample respondents aged 25 years or older indicates a statistically significant difference between the three groups. A greater proportion of the white respondents had a bachelor's degree or higher compared with the Hispanic and black respondents. While 36.1 percent of white respondents had attained a bachelor's or graduate degree, 25.0 percent of Hispanics had attained at least a bachelor's degree and only 15.9 percent of blacks had attained at least a bachelor's degree. Currently, there has not been an examination of the racial and ethnic breakdown of U.S. residents' educational attainment according to the 2010 Census, however according to the 2000 Census, 27.0 percent of whites and 10.4 percent of Hispanics had a bachelor's degree or higher. Compared to 2000 Census figures, it seems that the white and Hispanic sub-samples were more educated than their respective peers in the general population. However, the proportion of blacks

in this sub-sample compared to the proportion of blacks based on the 2000 Census with a bachelor's degree or higher are roughly similar (15.9 percent versus 14.3 percent respectively) (Bauman and Graf, 2003). In sum, although the descriptive statistics for the white and black sub-samples are roughly similar to the proportions found in the general population based on 2010 U.S. Census figures (with the notable exception of attained educational level for whites), the Hispanic sub-sample seemed proportionally to be younger, more female and more educated than Hispanics in the general population.

Table 4.2: Comparison of selected characteristics of Aims 1-3 sample by race for individuals 18 or older (n = 411).

	Whites n (%) [a]	Blacks n (%)	Hispanics n (%)	Chi-Square or ANOVA p-values
Total N by race	336 (--)	46 (--)	29 (--)	--
Male	161 (47.9)	21 (45.7)	11 (37.9)	Chi-square p-value = .777
Age				
18-44	137 (40.8)	22 (47.8)	16 (55.2)	ANOVA
45 to 64	130 (38.7)	14 (30.4)	13 (44.8)	p-value = .075
65 and older	70 (20.8)	10 (21.7)	0 (0.0)	
Educational attainment among those 25 or older [b]				
<HS	21 (7.0)	7 (15.9)	2 (8.3)	ANOVA
HS	144 (47.7)	30 (68.2)	13 (54.2)	p-value = .011
Associate's degree	28 (9.3)	--	3 (12.5)	
Bachelor's degree	70 (23.2)	5 (11.4)	5 (20.8)	
Graduate degree	39 (12.9)	2 (4.5)	1 (4.2)	

[a] Percentages may not always add up to 100 percent due to rounding purposes.

[b] The Census only reports educational attainment for individuals aged 25 and older. Total number of respondents aged 25 years of age or older by race are the following: whites = 302; blacks = 44; Hispanics = 24.

4.2.2 Measures

The primary independent variable for Aims 1-3's analyses is race. The three racial categories are white, black and Hispanic. All multiple regression analyses for Aims 1-3 were adjusted to control for possible confounding by the following socio-demographic variables: sex, age, educational attainment and geographic region (see p. 81 and p. 94 in Chapter 3 for an in-depth description of the independent variable and covariates).

The dependent variables that are analyzed in Aims 1-3 are the three RBM beliefs and attitudes variables. They are: RBM individual-level effectiveness, RBM behavioral orientation, and RBM population-level effectiveness (see pp. 82-85 in Chapter 3 for an in-depth description of the three dependent variable measures).

In addition to the aforementioned independent and dependent variables, the analyses for Aim 2 include genetic essentialist beliefs, which is tested as a mediator between race and RBM beliefs and attitudes (see p. 90 in Chapter 3 for a description of how genetic essentialist beliefs was measured). Aim 3 separately tests explicit racist attitudes and implicit racist attitudes as mediators of potential racial differences in RBM beliefs and attitudes (see pp. 91-92 in Chapter 3 for an in-depth description of how explicit and implicit racist attitudes were measured).

4.2.3 Analyses

SPSS Version 21.0's Complex Sampling Module was used to perform the data analysis in order to estimate the correct standard errors for the survey data, which has a complex sampling design. Depending on the aim, frequencies, crosstabulation and multiple linear regression

analyses were used to assess each specific aim. The following delineates the analyses for Aims 1-3.

Analysis of Aim 1. Several types of analyses were conducted in order to evaluate Aim 1, which assesses whether racial groups differ in their beliefs and attitudes regarding RBM individual-level effectiveness, behavioral orientation and population-level effectiveness. First, frequencies analyses were conducted on the total sample as a whole and by race. Crosstabulation analyses were then conducted to examine the extent to which beliefs about RBM's effectiveness at the individual level is consistent with attitudes towards using RBM. Multiple linear regression analyses were then conducted to assess potential racial differences in RBM beliefs and attitudes. Table 4.3 outlines the variables used for each Aim 1 regression analysis. Models 1, 3 and 5 tested whether there are differences in RBM beliefs among black and Hispanic respondents compared with white respondents by regressing each of the dependent variables on the race dummy variables as well as the control variables (sex, education, age and geographic region).

Models 2, 4 and 6 tested to see if race interacts with any of the socio-demographic control variables. Before these models were analyzed, I first tested to see if the total set of interactions as a group was significantly associated with each of the RBM dependent variables. The interaction terms are race by each socio-demographic variable other than geographic region (i.e. black or Hispanic by gender, education and age). For each RBM dependent variable, I constructed two multiple regression models to examine the set of interactions' overall effect on RBM beliefs and attitudes. The first model ("No Interactions") only included all of the socio-demographic variables that are potentially associated with RBM beliefs and attitudes. Those variables in this model are race (white, black and Hispanic with white as referent category), sex

(male = 1), education, age and geographic region (Northeast, Midwest, South, Rocky Mountain/Southwest, West, and Southeast, the last of which is the referent category). In the second model ("Interactions"), I added the interaction terms – black*male, black*education, black*age, Hispanic*male, Hispanic*education, and Hispanic*age – to the variables used in the No Interactions model. I then compared the R^2 values for both models by subtracting the R^2 value for the No Interactions model from R^2 for the Interactions model to evaluate whether overall the interactions had an effect on RBM individual-level effectiveness, behavioral orientation and population-level effectiveness. R^2 attributable to the interactions was calculated as:

$$\mathbf{R^2\text{-change} = R^2_{Interactions} - R^2_{No\ Interactions}}$$

If R^2-change was significant for a particular RBM dependent variable, then the individual interaction term estimates would be examined. The rationale for examining the interaction models was to see if there were additional social differences between racial groups. If interaction effects were found to be statistically significant between race and the socio-demographic variables, race-specific multiple regression analyses were then conducted to examine how each of the socio-demographic control variables may differentially be related to the dependent variables for each racial group (Models 7-9).

Table 4.3: Variables used in Aim 1 multiple regression models.

Variable Type	Models 1, 3, 5	Models 2, 4, 6	Models 7-9 (Race-Specific Models)
Dependent Variables	RBM individual-level effectiveness, behavioral orientation, and population-level effectiveness	RBM individual-level effectiveness, behavioral orientation, and population-level effectiveness	RBM individual-level effectiveness, behavioral orientation, and population-level effectiveness
Independent Variable(s)	Race	Race	Socio-demographic variables
Covariates	Socio-demographic variables [a]	Socio-demographic variables	--
Interaction Terms	--	Race* Socio-demographic variables	--

[a] The socio-demographic control variables are sex, education, age and geographic region.

Analysis of Aim 2. Multiple linear regression was used to analyze Aim 2, which tests genetic essentialist beliefs as a mediator between race and RBM individual-level effectiveness, behavioral orientation, and population-level effectiveness beliefs and attitudes. First, I tested to see whether there are racial differences in genetic essentialist beliefs by regressing genetic essentialist beliefs on the race dummy variables and the socio-demographic control variables. If racial differences were found for genetic essentialist beliefs, then genetic essentialist beliefs was only tested as a mediator for the RBM dependent variables for which racial differences were found in Aim 1. The analysis of Aim 2 follows Baron and Kenny's (1986) steps for testing mediation effects (see Table 4.4, Models 10-12). In these analyses, socio-demographic variables (sex, education, age and geographic region) were controlled to reduce potential confounding.

Table 4.4: Variables used in Aim 2 multiple regression models.

Variable Type	Model 10	Model 11[a]	Model 12
Dependent Variable(s)	Genetic essentialist beliefs	RBM individual-level effectiveness, behavioral orientation, and population-level effectiveness	RBM individual-level effectiveness, behavioral orientation, and population-level effectiveness
Independent Variable	Race	Race	Race
Covariates	Socio-demographic controls [b]	Socio-demographic controls	Socio-demographic controls
Mediator	--	--	Genetic essentialist beliefs

[a] Note, Model 11 is the same as Table 4.3's Models 1, 3, 5.
[b] The socio-demographic control variables are sex, education, age and geographic region.

Analysis of Aim 3. In this aim, implicit racist attitudes and explicit racist attitudes were tested as mediators between race and the RBM dependent variables. *Both attitudinal constructs were tested as mediators for only the white and Hispanic respondents and both were only analyzed if whites were significantly more likely than Hispanics to endorse RBM individual-level effectiveness, behavioral orientation and/or population-level effectiveness in Aim 1*. Baron and Kenny's (1986) steps for testing mediation effects were again followed and socio-demographic variables that were found to be significant in the Aim 1 multivariate analyses were controlled (see Table 4.5, Models 13-15).

Table 4.5: Variables used in Aim 3 multiple regression models.

Variable Type	Model 13	Model 14 [a]	Model 15
Dependent Variables	Implicit Racist Attitudes/ Explicit Racist Attitudes	RBM individual-level effectiveness, behavioral orientation, and population-level effectiveness	RBM individual-level effectiveness, behavioral orientation, and population-level effectiveness
Independent Variable	Race	Race	Race
Covariates	Socio-demographic controls [b]	Socio-demographic controls	Socio-demographic controls
Mediators	--	--	Implicit Racist Attitudes/ Explicit Racist Attitudes

[a] Note, Model 14 is the same as Table 4.3's Models 1, 3, 5.
[b] The socio-demographic control variables are sex, education, age and geographic region.

4.3 Results:

4.3.1 Aim 1: Beliefs and Attitudes towards Race-Based Medicine

4.3.1.1 Race-Based Medicine Individual-Level Effectiveness

Table 4.6 presents frequencies for beliefs and attitudes towards RBM among the total sample. It shows that 38.5 percent of the total sample agreed with the belief that RBM is effective at the individual level, while 11.9 percent neither agreed nor disagreed with this belief, and 49.6 percent disagreed (total sample mean = 2.35, SE = .048). The results show that a majority of the respondents do not believe RBM is effective at the individual level.

Table 4.6 also presents the frequencies for RBM individual-level effectiveness belief by race; the similar percentages of whites, blacks and Hispanics who agreed, disagreed or neither agreed nor disagreed with statements endorsing RBM individual-level effectiveness indicate that

there is no association between race and this belief. Like the sample as a whole, the majority of white, black and Hispanic respondents do not believe RBM is effective at the individual level.

Table 4.6: Agreement/disagreement with RBM belief statements for total sample and by race/ethnicity.

Dependent variables	Total, %	Whites, %	Blacks, %	Hispanics, %
Race-based medicine is effective at individual level	(n = 403)	(n = 330)	(n = 45)	(n = 28)
Agree	38.5	38.8	37.8	39.3
Neither agree nor disagree	11.9	11.2	17.8	7.1
Disagree	49.6	50.0	44.4	53.6
Prefer to use race-based medicine	(n = 402)	(n = 329)	(n = 45)	(n = 28)
Strongly/somewhat agree	68.2	69.0	64.4	64.3
Strongly/somewhat disagree	31.8	31.0	35.6	35.7
Race-based medicine is effective at population level	(n = 403)	(n = 329)	(n = 45)	(n = 29)
Strongly/somewhat agree	35.7	31.9	51.1	55.2
Strongly/somewhat disagree	64.3	68.1	48.9	44.8

Note. All reported results are weighted.

A multiple linear regression analysis of RBM individual-level effectiveness regressed on race, controlling for sex, age, education and geographic region was conducted to examine whether or not race is in fact associated with RBM individual-level effectiveness beliefs.

Standardized regression estimates (see Table 4.7, Model 1) confirm that there is no statistically significant difference among whites, blacks and Hispanics for RBM individual-level effectiveness belief.

It should be noted that despite the lack of an association between race and RBM individual-level effectiveness belief, there were statistically significant associations between RBM individual-level effectiveness and both sex and education (Table 4.7, Model 1). Males were significantly more likely than females to believe that RBM is effective at the individual level ($p < .05$). Meanwhile, a positive association between education and RBM individual-level effectiveness indicates that the greater the educational attainment level of respondents, the more likely they were to believe RBM is effective at the individual level ($p < .10$).

R^2-change was then calculated for the RBM individual-level effectiveness multiple linear regression model that compared the effect of the race by socio-demographic variables interaction terms as a set with the model that did not have interactions. R^2-change was statistically significant ($p < .01$), indicating that the interaction terms as a set have a significant effect on RBM individual-level effectiveness. Possible interaction effects between race and the socio-demographic variables for RBM individual-level effectiveness belief were then examined in order to assess whether there were sex, age or education differences in associations with RBM individual-level effectiveness between racial groups. Table 4.7's Model 2 shows significant interactions between the Hispanic dummy variable and both sex and age for RBM individual-level effectiveness belief. Race-specific regression analyses were conducted for RBM individual-level effectiveness to further explore these interactions. Table 4.8 presents the results for the race-specific multiple linear regression analyses examining the relationship between the

socio-demographic control variables and the RBM dependent variables. The results from Model 7 in Table 4.8 indicate that Hispanic men are more likely than Hispanic women to believe RBM is effective at the individual level ($p < .10$). Among whites, men also seem to be more likely than women to believe RBM is effective at the individual level ($p < .10$), although the magnitude of the estimate for whites was substantially less than that for the Hispanic sample. Black men and women did not differ in their beliefs about RBM individual-level effectiveness.

Model 7 also shows that among whites ($p < .10$) and blacks ($p < .05$), education was positively associated with RBM individual-level effectiveness, indicating that the higher the educational-level background of white respondents, the more likely they were to endorse RBM individual-level effectiveness. There was no association between education and RBM individual-level effectiveness among Hispanic respondents.

Finally, the results show that the older Hispanic respondents were, the less likely they were to endorse RBM individual-level effectiveness beliefs ($p <. 001$), but there was no association between age and RBM individual-level effectiveness beliefs among the white and black respondents.

Although race was not significantly associated with RBM individual-level effectiveness belief, a closer examination of potential interactions between race and other covariates in the model indicated that Hispanic and white respondents significantly differed in their associations between both sex and age and RBM individual-level effectiveness. Between whites and blacks, however, there did not seem to be any sex or age differences in RBM individual-level effectiveness belief. In addition, although there was a significant positive association between education and RBM individual-level effectiveness among whites and blacks but no association

among Hispanics, the association among whites was not significantly different compared with Hispanics.

Hypothesis 1 stated that there would be racial differences in RBM individual-level effectiveness belief such that whites would be more likely to endorse RBM individual-level effectiveness than blacks and Hispanics. While whites and blacks did not significantly differ in this belief, whites and Hispanics did significantly differ in so far as the associations between sex and age with RBM individual-level effectiveness for these two groups. Despite differences found between whites and Hispanics, the evidence does not indicate that overall, whites are more likely to endorse RBM individual-level effectiveness. Thus, Hypothesis 1 does not seem to be supported by the results for RBM individual-level effectiveness.

Table 4.7: Standardized regression estimates for RBM beliefs and attitudes (n = 399).

Independent variables	Race-based medicine is effective at individual level		Prefer to use race-based medicine		Race-based medicine is effective at population level	
	Model 1, β (SE)	Model 2, β (SE)	Model 3, β (SE)	Model 4, β (SE)	Model 5, β (SE)	Model 6, β (SE)
Intercept	1.714	1.562	1.601	1.371	1.917	1.943
	(.319)***	(.325)***	(.444)***	(.424)**	(.332)***	(.325)***
Black	.111	-.629	.096	-.583	.492	-.814
	(.141)	(1.100)	(.297)	(1.849)	(.224)*	(1.122)
Hispanic	-.143	1.326	.041	2.617	.679	-.139
	(.253)	(.925)	(.402)	(1.367)	(.327)*	(1.285)
Male	.205	.196	.146	.079	.137	.059
	(.095)*	(.102)†	(.129)	(.124)	(.110)	(.107)
Education	.045	.047	.063	.069	-.011	-.016
	(.024)†	(.026)†	(.034)†	(.032)*	(.028)	(.028)
Age	.001	.002	.007	.010	.005	.004
	(.003)	(.003)	(.004)*	(.003)**	(.003)	(.003)
Northeast	.055	.118	.328	.415	.284	.374
	(.175)	(.172)	(.228)	(.201)	(.190)	(.190)*
Midwest	.035	.127	.131	.195	-.062	.074
	(.138)	(.138)	(.195)	(.174)	(.148)	(.144)
South	-.056	-.040	.203	.166	-.169	-.033
	(.153)	(.146)	(.235)	(.191)	(.192)	(.187)
Rocky Mountain/	.160	.237	.453	.517	-.082	.018
Southwest	(.222)	(.215)	(.280)	(.267)†	(.189)	(.183)
West	.135	.224	.172	.288	.178	.323
	(.160)	(.155)	(.214)	(.192)	(.207)	(.200)
Black*Male	-	-.171	-	-.430	-	.591
		(.256)		(.499)		(.350)
Hispanic*Male	-	.889	-	1.974	-	.797
		(.230)***		(.357)***		(.790)
Black*Education	-	.059	-	.154	-	-.004
		(.087)		(.164)		(.102)
Hispanic*Education	-	.047	-	-.092	-	.195
		(.116)		(.173)		(.138)
Black*Age	-	.007	-	-.012	-	.024
		(.009)		(.016)		(.012)†
Hispanic*Age	-	-.056	-	-.060	-	-.035
		(.009)***		(.013)***		(.020)
R^2	.046	.102	.045	.133	.086	.132

†$P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$. *Note:* All reported results are weighted. SE = standard error.

Table 4.8: Race-specific standardized regression estimates for RBM beliefs and attitudes.

Independent variables	Race-based medicine is effective at individual level	Prefer to use race-based medicine	Race-based medicine is effective at population level
	Model 7 β (SE)	Model 8 β (SE)	Model 9 β (SE)
Male			
White [a]	.196 (.102)†	.079 (.122)	.062 (.107)
Black [b]	-.123 (.223)	-.423 (.514)	.407 (.368)
Hispanic [c]	1.014 (.478)†	2.281 (.548)**	1.931 (.662)*
Education			
White	.048 (.026)†	.069 (.032)*	-.019 (.027)
Black	.186 (.068)*	.332 (.168)†	.051 (.104)
Hispanic	.180 (.123)	.106 (.186)	.079 (.151)
Age			
White	.003 (.003)	.011 (.003)**	.004 (.003)
Black	.009 (.007)	.005 (.014)	.023 (.011)†
Hispanic	-.046 (.015)*	-.042 (.020)†	-.035 (.022)

†$P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$. *Note:* All reported results are weighted. SE = standard error.
[a] n for the white sample is 328. [b] n for the black sample is 43. [c] n for the Hispanic sample ranged from 28 to 29.

4.3.1.2 Race-Based Medicine Behavioral Orientation

Although the majority of the total sample of respondents, as well as white, black and Hispanic respondents, did not believe that RBM would be effective at the individual level, Table 4.6 shows that the majority of the sample's respondents (68.2 percent) indicated a preference for using a race-specific drug if it was an available treatment option (total sample mean = 2.85, SE =

.068). Because the proportion of respondents who positively indicated a preference for using RBM was so much greater than the proportion of those who endorsed RBM individual-level effectiveness, a crosstabulation analysis of RBM individual-level effectiveness by RBM behavioral orientation (Table 4.9) was undertaken to identify the proportion of respondents who do not believe RBM is effective at the individual level but would nonetheless prefer to use RBM if it was an available form of treatment. Table 4.9 shows that of the 200 respondents who disagreed with the belief that RBM is effective at the individual level, 83 either somewhat or strongly agreed with the attitude that they would prefer to use RBM. This means that 41.5 percent of those individuals who do not believe RBM would be effective at the individual level would still prefer to use RBM if it was available.

Table 4.9: Crosstabulation of race-based medicine is effective at individual level by preference to use race-based medicine if it is available (n = 402).

Prefer to use race-based medicine	Race-based medicine is effective at the individual level			
	Agree (% of column total)	**Neither agree nor disagree (% of column total)**	**Disagree (% of column total)**	**Total (% of column total)**
Strongly/somewhat agree	146 (94.8)	44 (91.7)	83 (41.5)	273 (67.9)
Strongly/somewhat disagreed	8 (5.2)	4 (8.3)	117 (58.5)	129 (32.1)
Total	154	48	200	402

Model 3 in Table 4.7 (p. 137) is a multiple linear regression analysis of the relationship between race and RBM behavioral orientation, adjusted for sex, education, age and geographic region. The results of the model show that there is no association between race and behavioral orientation. In order to see if potential interaction effects between race and the socio-demographic variables as a set had an effect on RBM behavioral orientation, R^2-change was calculated between the multiple linear regression models that included and excluded the interaction terms. R^2-change indicated that the set of interactions had a significant effect on RBM behavioral orientation ($p < .01$). Potential interaction effects between race and sex, education and age were then examined in order to identify which of the associations between RBM behavioral orientation and the latter three socio-demographic variables differed among white, black and Hispanic respondents. Model 4 in Table 4.7 (p. 137) shows statistically significant interaction associations between the Hispanic dummy variable and both sex and age, indicating that the relationship between sex and behavioral orientation, as well as age and behavioral orientation, are different between Hispanics and whites. Race-specific model results in Table 4.8 (p. 138) show that like RBM individual-level effectiveness, Hispanic males were more likely than Hispanic females to prefer the use of RBM ($p < .01$), but there was no significant difference between white males and females or black males and females.

Education and RBM behavioral orientation were significantly associated among whites such that as educational attainment level increased, whites were more likely to prefer to use RBM. This also seemed to be the case for blacks ($p < .10$) but not for Hispanics.

The race-specific RBM behavioral orientation models also show that as age increased for Hispanic respondents, they were *less* likely to prefer to use RBM ($p < .10$), but as age increased

for white respondents, they were *more* likely to prefer to use RBM ($p < .01$). There was no association between age and RBM behavioral orientation among black respondents.

Although the Aim 1 results show no overall racial differences for RBM behavioral orientation, upon closer examination, the interaction models and race-specific multiple linear regression models show some differences, particularly between whites and Hispanics. However, because the results do not show that whites are more likely to prefer to use RBM than blacks and Hispanics, the results do not show support for Hypothesis 1 with respect to RBM behavioral orientation.

4.3.1.3 Race-Based Medicine Population-Level Effectiveness

Similar to the RBM individual-level effectiveness results for the total sample, the results presented in Table 4.6 show that only a minority of respondents (35.7 percent) believe in the possibility of RBM being effective at reducing population-level disparities (total sample mean = 2.20, SE = .061). Unlike the findings for RBM individual-level effectiveness and behavioral orientation, Table 4.6 shows that there were differences in RBM population-level effectiveness belief among the three racial groups. While only 31.9 percent of whites sampled in the study believe RBM would reduce health inequalities, 51.1 percent of black respondents and 55.2 percent of Hispanic respondents agreed with this belief. Multiple linear regression was used to examine whether race is significantly associated with RBM population-level effectiveness. After adjusting for sex, education, age and geographic region (Table 4.7**,** Model 5), positive associations were found for both the black and Hispanic variables ($p < .05$), indicating that both groups are more likely to believe RBM will reduce health inequalities than white respondents.

Sex, education, age and geographic region were not significantly associated with RBM population-level effectiveness belief.

In order to see if potential interaction effects between race and the socio-demographic variables as a set had an effect on RBM population-level effectiveness, R^2-change was calculated between the multiple linear regression models that included and excluded the interaction terms. R^2-change indicates that the set of interactions had a significant effect on RBM population-level effectiveness ($p < .01$). The individual interaction term estimates were then examined to see which socio-demographic variables were differentially associated with RBM population-level effectiveness by race. The regression model shows possible associations between the black dummy variable and both gender ($p < .10$) and age ($p < .10$) for RBM population-level effectiveness.

Race-specific regression analyses for whites and blacks (Table 4.8, Model 9), however, showed that there was no significant association between gender and RBM population-level effectiveness for whites or blacks, but there was a significant association among Hispanics indicating that males were more likely than females to believe that RBM has the potential to improve health inequalities ($p < .05$). With respect to the race by age interaction effect, there was no significant association between age and beliefs about RBM's effect on health inequalities among white respondents. There was, however, a positive association for black respondents ($p < .10$), indicating that the older the black respondents were the more likely they were to believe that RBM would reduce population-level health inequalities.

In sum, Hispanics and blacks differed from whites in their belief that RBM would be effective at the population level in reducing health disparities, however, these differences were

not in the expected direction. Thus, Hypothesis 1 is not supported for RBM population-level effectiveness.

4.3.1.4 Summary of Aim 1 Results

For Aim 1, I hypothesized that whites would be more likely than blacks and Hispanics to endorse RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes. The results from this study indicate that there are no overall racial differences in endorsement levels of RBM individual-level effectiveness and behavioral orientation, however, interaction effects were found between the Hispanic dummy variable and sex and age for both dependent variables. Hispanics significantly differed from whites with respect to the relationship between sex and age and the two aforementioned RBM dependent variables, indicating tangential support for Hypothesis 1 with respect to the existence of differences between whites and Hispanics for these two RBM dependent variables. However, I could not conclude that whites overall were *more* likely than Hispanics to endorse these beliefs and attitudes.

Despite the lack of overall racial differences for these two RBM dependent variables, racial differences were found for RBM population-level effectiveness belief, although not in the expected direction. Hypothesis 1 proposed that whites would be more likely than blacks and Hispanics to endorse RBM population-level effectiveness, however, the results indicated the opposite – white respondents were *less* likely than blacks and Hispanics to believe that RBM would be effective at reducing health disparities. In sum, the evidence from this study indicates

that there are some racial differences in RBM beliefs and attitudes, although not in the expected directions.

4.3.2 Aim 2: Genetic Essentialist Beliefs as Potential Mediator

The purpose of Aim 2 is to examine whether genetic essentialist beliefs help explain racial differences in RBM beliefs and attitudes, but only for RBM dependent variables for which overall racial differences were found in Aim 1. Because overall differences were found between whites, blacks and Hispanics for RBM population-level effectiveness (even though they were not in the expected direction), Aim 2 analyses are warranted.

Table 4.10 (p. 145) presents race-specific frequencies for genetic essentialist beliefs. The frequencies analysis shows 6 percent of whites, 7 percent of blacks, but no Hispanics indicated that genes are the most important factor for determining both health and intelligence. Thirty-four percent of whites, 33 percent of blacks and 19 percent of Hispanics indicated that genes were the most important factor in determining either health or intelligence, but not both. Sixty percent of whites, 61 percent of blacks and 81 percent of Hispanics did not believe genes were the most important factor in determining either health or intelligence. A multiple linear regression model was then constructed where genetic essentialist beliefs, an index variable based on two items (see p. 90 in Chapter 3 for description), was regressed on race and adjusted for sex, education, age and geographic region. Table 4.11 (p. 146) shows that whites were significantly more likely than Hispanics to endorse genetic essentialist beliefs ($p < .05$). Black and white respondents, however, did not significantly differ.

Table 4.10: Frequencies for endorsement of genetic essentialist beliefs by race (n = 395).

Endorses genetic essentialist beliefs	Whites (% of total white respondents)	Blacks (% of total black respondents)	Hispanics (% of total Hispanic respondents)	Total (% of total respondents)
Believes genes are most important factor for determining health and intelligence	19 (6%)	3 (7%)	0 (0%)	22 (5%)
Believes genes are most important factor for determining health or intelligence, but not both	109 (34%)	15 (33%)	5 (19%)	129 (33%)
Does not believe genes are most important factor for determining either health or intelligence	194 (60%)	28 (61%)	22 (81%)	244 (62%)
Total	322	46	27	395

Table 4.11: Standardized regression estimates for genetic essentialist beliefs regressed on race (n = 392).

Independent Variables	Genetic essentialist beliefs
	Model 10 β (SE)
Intercept	.025 (.249)
Black	.021 (.151)
Hispanic	-.231 (.100)*
Male	.008 (.076)
Education	.016 (.020)
Age	.003 (.002)
Northeast	.161 (.120)
Midwest	.158 (.131)
South	.109 (.113)
Rocky Mountain/Southwest	.163 (.167)
West	.297 (.140)*

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

According to Baron and Kenny's steps for testing mediation effects, because there was a statistically significant race-specific difference in genetic essentialist beliefs, genetic essentialist beliefs can be tested as a mediator between race and RBM population-level effectiveness. Table 4.12's Model 11 shows the regression estimates for RBM population-level effectiveness belief regressed on race and the control variables. As originally noted in the Aim 1 results, blacks and

Hispanics were significantly more likely to endorse RBM population-level effectiveness. Table 4.12's Model 12 shows the results of testing genetic essentialist beliefs as a mediator between race and RBM population-level effectiveness. The results show that the addition of genetic essentialist beliefs into the regression model only slightly attenuates the association between the Hispanic dummy variable and the black dummy variable and RBM population-level effectiveness. Genetic essentialist beliefs was not significantly associated with RBM population-level effectiveness ($\beta = .023$, SE = .089). Baron and Kenny note that in order for a variable to be a mediator between two other significantly associated variables, the mediator must also be significantly associated with the dependent variable. Because this is not the case for genetic essentialist beliefs and RBM population-level effectiveness, the results indicate that genetic essentialist beliefs do not mediate the association between race and RBM population-level effectiveness. Hypothesis 2, therefore, is not supported.

Table 4.12: Multiple linear regression estimates testing genetic essentialist beliefs as a mediator between race and RBM population-level effectiveness.

Independent Variables	RBM population-level effectiveness regressed on race (n = 399)	RBM population-level effectiveness regressed on race and genetic essentialist beliefs (n = 398)
	Model 11 β (SE)	**Model 12 β (SE)**
Intercept	1.917 (.332)***	2.097*** (.075)
Black	.492 (.224)*	.449 (.255)†
Hispanic	.679 (.327)*	.627 (.321)†
Male	.137 (.110)	-- [a]
Education	-.011 (.028)	--
Age	.005 (.003)	--
Northeast	.284 (.190)	--
Midwest	-.062 (.148)	--
South	-.169 (.192)	--
Rocky Mountain/Southwest	-.082 (.189)	--
West	.178 (.207)	--
Genetic essentialist beliefs	--	.023 (.089)

†$P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$.

[a] Male, education, age and geographic region dummy variables were removed as covariates from Model 12 because they were not significantly associated with the dependent variable in Model 11.

4.3.3 Aim 3: Explicit and Implicit Racist Attitudes as Potential Mediators

Aim 3 examines whether implicit racist attitudes and/or explicit racist attitudes mediate any significant associations between race and RBM individual-level effectiveness, behavioral orientation and/or population-level effectiveness beliefs. It should be noted that both the implicit racist attitudes and explicit racist attitudes constructs examine racist attitudes towards blacks, therefore, only white and Hispanic respondents would be included in this analysis. I had proposed that this aim would only be examined if white respondents were found to endorse at least one of the three RBM-related dependent variables at greater levels than the black and Hispanic respondents in Aim 1. Because whites did not endorse any of the RBM-related dependent variables at significantly greater levels than blacks and Hispanics, Aim 3 analyses were not warranted.

4.4 Discussion

The development of RBM continues to be a controversial endeavor in the U.S. Many within the academic and clinical communities question the effectiveness of race-specific treatments and are concerned with numerous negative consequences, such as the (re)geneticization of race and its various social and political implications (Foster et al., 2001; Duster, 2005; Kahn, 2006; Ng et al., 2008; Phelan, Link and Feldman, 2013). However, there is scant knowledge about the American public's beliefs and attitudes regarding RBM, both for the population as a whole and by the race and ethnicity of individuals. As the biomedical industry moves forward to develop RBM, consideration must be given to the American public's beliefs

and attitudes, since public conceptions about RBM's effectiveness could impact its acceptance and usage.

4.4.1 Lay Beliefs about RBM's Individual-Level Effectiveness and Preferences for Using RBM

The results of this study show that a majority of respondents overall do not believe RBM is effective at either the individual or population levels. Despite these beliefs, a majority of the public would prefer to use race-specific drugs if they were available. One possible reason for this inconsistency between beliefs and behavior is that a portion of respondents who indicated a preference for using RBM would instead prefer either treatment based on individualized genetic testing or the usual course of treatment, if such options had been presented in our survey (Bevan et al., 2003). The substantial number of respondents who indicated a preference for using RBM even if they didn't believe it was effective, however, could also reflect a desire to try treatments with potentially significant benefits, even if one's initial instinct is to believe such treatments do not work. It is also possible that some of the respondents, based on things that they have heard or learned over the years, may be socialized to believe that RBM is ineffective or otherwise "bad", but when it comes down to making a concrete decision that they think would benefit them, they do not apply this acquired attitude to their behaviors. The inconsistency between belief and behavior may also result from some respondents believing RBM is an attractive idea, but seemingly abstract.

Another reason that could explain this inconsistency is the possibility that racial concepts can be situational or context-driven. Morning (2009), in her study examining various methodological approaches to measuring racial conceptualization, found that the measurement of

respondents' racial concepts was extremely sensitive to the measurement technique that was used. Racial concepts shifted depending on whether respondents answered open-ended questions asking them to define race, responded to true/false statements about race, or provided explanations for two real-life racial differentials. Although only one type of measurement technique was used in this dissertation study of RBM-related beliefs and attitudes, it is possible that some respondents' beliefs and attitudes are situationally affected, resulting in responses to belief items about the larger population that diverged from responses for a specific situation involving their own personal behavior.

The inconsistency between RBM beliefs and behavioral orientation was also seen in a previous U.S.-based study that found the majority of its respondents to be "suspicious" about RBM, but with a portion noting they would still use it if it was available (Bevan et al., 2003; Lynch & Dubriwny, 2006). Lynch and Dubriwny (2006) contend this inconsistency can be explained by their "double bind" theory that some individuals, in particular racial and ethnic minorities, dispute a genetic basis for race, however, their racial/ethnic identification places them in a double bind between choosing to use RBM — which may imply what they are disputing — or forgoing use of RBM, which could be perceived as denying their racial identity. Racial or ethnic identification is a way for individuals to find common cause and to be socialized into the associated group's culture (Lynch & Dubriwny, 2006). Studies have shown that blacks have a greater degree of racial-ethnic identification than whites, which can explain why actions that could be perceived as denying one's racial identity are often discouraged (Allen, Howard, & Grimes, 1997; Coard, Breland, & Raskin, 2001). Therefore, although choosing to use or not use RBM each comes with perceived negative consequences for some people, ultimately, some will still choose the former option of using RBM as the lesser of two "evils".

The discordant finding between RBM individual-level effectiveness belief and behavioral intentions is an important finding for which drug makers and providers should take note. Despite potentially negative public opinions towards RBM and its development, this finding suggests that there is an incentive for drug makers to continue to develop and market RBM because for the moment, the findings from this study indicate a large market of consumers who would be willing to use RBM.

Hypothesis 1 contended that whites would be more likely to endorse RBM-related beliefs and attitudes since prior qualitative research (Bevan et al., 2003) indicated such differences exist. However, the results from this study did not support the hypothesis that blacks and Hispanics are less likely to endorse the belief that RBM is effective at the individual level and less likely to prefer to use RBM if it was available. Nearly equal proportions of whites, blacks and Hispanics agreed with the belief that RBM would be effective at the individual level (respectively, 38.5 percent, 38.8 percent and 37.8 percent agreed with this belief). In addition, nearly equal proportions of whites, blacks and Hispanics agreed with the attitude that they would prefer to use RBM if it was available, with approximately two-thirds of each of the three racial groups indicating a preference to use RBM (69.0 percent of whites, 64.4 percent of blacks, and 64.3 percent of Hispanics).

Although no overall racial differences were found for RBM individual-level effectiveness and behavioral orientation, the findings show that sex moderates the relationship between race and both dependent variables. Hispanic males were more likely to believe RBM is effective at the individual level and more likely to prefer using RBM than Hispanic females, but no statistically significant sex difference for either construct was found among blacks and whites

(although there seemed to be a trend that white males were more likely to endorse RBM individual-level effectiveness than white females). These interaction effects somewhat diverge from Bevan and colleagues' study (2003) that found an interaction between sex and ethnicity in suspicions about RBM. In their study, Hispanic males were more suspicious about RBM than other ethnic and sex groups while European American males were the least suspicious. The reasons that could explain the sex differences between Hispanics, blacks and whites in this study are unclear, however, these differences suggest potential barriers to the widespread use of RBM, including different levels of willingness to use RBM by different populations, even though differences were not found overall by racial group.

The focus of this analysis was race, however notably, some non-race-specific social differences were found, including a positive association between education – an important indicator of socioeconomic status – and both RBM individual-level effectiveness and behavioral orientation. The greater the educational level of respondents, the more likely they were to believe RBM is effective at the individual level and/or to prefer to use RBM. A possible explanation for these associations could be that genetic causal beliefs for extant inequalities resonate most strongly among those who occupy socially privileged positions because such beliefs can justify social hierarchies (Jayaratne et al., 2006; Nelkin & Lindee, 1995). Although RBM is not necessarily a genetic treatment, it implies genetic differences between racial groups. Notably, these results are in contrast to Shostak and colleagues' (2009) finding that the socioeconomically advantaged were *not* more likely to endorse the belief that genetic make-up is important in determining health and social outcomes.

An alternative, and potentially more plausible, explanation for the positive association between education and RBM individual-level effectiveness belief and behavioral orientation could be that higher educational attainment is associated with greater positive attitudes towards new scientific technologies, since there is evidence to suggest that greater scientific knowledge is associated with more positive attitudes towards science in general (Einsiedel, 1994; Evans & Durant, 1995). A test of this latter theory is beyond the scope of this study, but warrants further attention in future studies.

It should be noted that a previous focus group study did find a main effect for race in data examining suspicious attitudes towards RBM (Bevan et al., 2003). This study found that African American, Hispanic and multiracial American participants were more "suspicious" of RBM than European American focus group participants. Despite the many benefits associated with qualitative research data, the external generalizability of qualitative data findings is limited, therefore, one aim of this dissertation study was to examine whether such racial differences in RBM beliefs held up in an analysis of data collected from a nationally representative sample of Americans. The results of this study conflict with the prior qualitative study that found racial differences in RBM beliefs and attitudes (although it should be noted that the dependent variables in this study were slightly different than those used in the other study). This study's findings suggest that in the U.S., whites, blacks and Hispanics may in fact hold similar overall beliefs and attitudes regarding the individual-level effectiveness of RBM and preferences for using RBM. Thus, concerns regarding differential acceptance levels of RBM by race/ethnicity, particularly lower acceptance among minority populations, may not be warranted (Bevan et al., 2003; Lynch & Dubriwny, 2006).

4.4.2 Lay Beliefs about RBM and Health Inequalities

Although there do not seem to be overall racial differences in RBM-related individual-level effectiveness and behavioral orientation beliefs and attitudes, both black and Hispanic Americans endorsed to a greater extent than white Americans the belief that RBM would be effective at the population level. In the ongoing debate over how to address growing health inequalities between minority and non-minority populations, this is an important public opinion finding that should be considered within the larger debate. Robert and Booske (2011) recently found that racial and ethnic minorities in the U.S. were more likely than non-Hispanic whites to believe that nearly all potential causes of individual-level health status (ranging from access to affordable health care, to stress, to having a job, to where a person lives) had strong influences on health status. Expanding on this finding, if racial and ethnic minority populations in the U.S. are more likely to believe that many, if not most, of the identified causal factors associated with health have strong influences on health status, then it is possible that these populations also believe that most of these identified causal factors have strong influences on the production of health inequalities. This would be because less access to health-promoting causal factors of health status, and greater exposure to illness and disease-related causal factors combined should lead to population-level health inequalities. Consequently, these beliefs may also make blacks and Hispanics more inclined to believe that greater availability of/access to treatments tailored to specific racial and ethnic populations would have a strong influence on reducing health inequalities, even if their instinct is to believe that such treatments should not work (as evidenced by low frequencies of blacks and Hispanics who believed RBM would be effective at the individual level).

In this debate over identifying and implementing effective strategies to reduce health inequalities, public opinion from the populations that are disproportionately burdened with poorer health statuses and outcomes needs to be assessed in order to garner public support for identified strategies. If a majority of racial and ethnic minority populations are likely to believe that RBM could reduce health inequalities, then it is quite possible that they would be as likely – or more likely – than whites to support RBM as a tactic to reduce health inequalities.

It should be noted that RBM has had a limited presence in the delivery of healthcare services, and although RBM knowledge levels were not assessed in this study, it would be reasonable to assume that the majority of the lay public is unfamiliar with the concept of RBM. Should the healthcare industry decide to promote RBM as a strategy for addressing racial and ethnic health inequalities, there will likely be efforts on both sides of the debate to better educate the public about RBM. Depending on which side of the debate is more effective at communicating its messages about RBM, these efforts could influence in different directions beliefs about RBM's effectiveness at the individual- and population-levels and behavioral orientations towards using RBM.

4.4.3 Factors Associated with Racial Differences in RBM Beliefs

The purpose of Aims 2 and 3 was to examine factors that may help explain any racial differences found for RBM individual-level effectiveness, behavioral orientation and/or population-level effectiveness beliefs and attitudes. Genetic essentialist beliefs and implicit and explicit racist attitudes were proposed as potential mediators of associations between race and the three RBM dependent variables. However, these constructs were only examined for those

variables for which racial differences were actually found (in the case of Aim 2) or if whites specifically were found to endorse one or more of the RBM-related dependent variables at greater levels than blacks and Hispanics (in the case of Aim 3). Because race was significantly associated with only RBM population-level effectiveness, genetic essentialist beliefs was examined as a mediator for only this dependent variable. The results show that while there was a significant difference between white and Hispanic respondents for genetic essentialist beliefs, it was not a mediator of racial differences found for RBM population-level effectiveness. Implicit and explicit racist attitudes were not examined because whites were not found to endorse RBM individual-level effectiveness, behavioral orientation or population-level effectiveness at greater levels than blacks or Hispanics.

It should be noted that genetic essentialist beliefs and explicit and implicit racist attitudes were proposed as potential mediators between race and the RBM dependent variables because of prior research demonstrating that many non-Hispanic white Americans believe there is at least some genetic basis to race, and, research associating belief in biological/genetic differences between races with racist attitudes (Jayaratne et al., 2006; Kinder & Sanders, 1996; Keller, 2005; Sheldon, Jayaratne & Petty, 2007). Because there is the belief among some scientists and members of the lay public who are familiar with RBM that its effectiveness is based on its ability to address biological or genetic differences between racial groups, this dissertation study hypothesized that genetic essentialist beliefs, explicit racist attitudes and implicit racist attitudes may therefore be mediators of possible racial differences among the lay public in RBM beliefs and attitudes. However, because there was *no* racial difference in beliefs about RBM's effectiveness at the individual level, it seems possible that differences in beliefs about RBM's effectiveness at the population level may less reflect belief differences about whether RBM

could effectively treat entire populations of patients than belief differences regarding the effectiveness of all different types of population-level interventions for addressing health disparities. Simply put, blacks and Hispanics may differ from whites in their beliefs about the effectiveness of most previous and current efforts to address racial and ethnic health disparities, and consequently, such belief differences would not be modified by RBM as a strategy to address health disparities regardless of whether these groups believe RBM is clinically effective. This may explain why genetic essentialist beliefs were not found to be a mediator of racial differences in RBM population-level effectiveness belief, and why testing racist attitudes as a possible mediator was not even warranted.

Alternatively, the term "health inequalities" may in and of itself be a concept with which there are differing levels of familiarity or understanding within the general population. Because this concept was not defined to the survey participants, it is also possible that racial differences in RBM population-level effectiveness belief reflect racial differences in familiarity with the concept of health inequalities more so than differences in beliefs about RBM's potential effectiveness at reducing health inequalities.

4.4.4 Why don't whites and blacks differ more?

It should be noted that the only significant racial difference that was found was between whites, blacks and Hispanics for only RBM population-level effectiveness. The majority of both black and white respondents did not believe RBM would be effective at the individual level, but the majority of both groups indicated they would prefer to use RBM if it was available. The lack of significant differences between whites and blacks for RBM individual-level effectiveness

beliefs and behavioral orientation is surprising in light of the known differences between these two groups on many race-related beliefs, attitudes and policies (Bobo & Charles, 2009; Schoen, 2012). Prior qualitative research on RBM-related beliefs and attitudes had also suggested that black-white differences would be found for RBM individual-level effectiveness and behavioral orientation in this study (Bevan et al., 2003; Condit et al., 2003; Marco, 2010). A simple explanation for the lack of difference between whites and blacks in this study could be that the black sample was relatively small and a larger sample perhaps would have found racial differences. Alternatively, it is possible that a lack of knowledge about RBM among most Americans regardless of race resulted in the limited diversity in beliefs about and attitudes towards RBM.

However, if sample size and RBM knowledge levels were not meaningful limitations to the study, then it seems that white and black Americans indeed hold similar beliefs about and attitudes towards RBM. One consequence of this is that industry-based RBM proponents may find a generally receptive patient population for the delivery of RBM. However, it is possible that armed with more information, particularly information regarding the potential clinical, ethical and social costs and benefits associated with RBM, whites and blacks would begin to diverge in their beliefs and attitudes. Therefore, future research should consider assessing RBM knowledge levels, and if possible, the implications of an intervention that examines RBM beliefs and attitudes after respondents are exposed to varied pieces of information about RBM's clinical, ethical and social costs and benefits. Ultimately, RBM proponents' concerns about non-white populations' receptiveness to using RBM may be unwarranted. Meanwhile, RBM opponents may need to implement interventions to better communicate concerns associated with RBM if one of their goals is to garner lay support for rejecting efforts to promote RBM in the U.S.

Chapter 5:

PART 2: VIGNETTE EXPERIMENT'S EFFECTS ON RACE-BASED MEDICINE BELIEFS AND ATTITUDES

5.1 Introduction

The previous chapter's analysis of data examining beliefs about the effectiveness of RBM and attitudes towards using RBM indicates that there are few racial/ethnic differences in these beliefs and attitudes among white, black and Hispanic Americans. Although this dissertation study was unable to collect data on RBM-related knowledge levels, presumably, RBM is a concept with which few Americans are familiar. If low familiarity with RBM is part of the reason why there were few racial differences in RBM-related beliefs and attitudes, then one question that arises is whether racial differences in RBM-related beliefs and attitudes would begin to emerge depending on exposure to varying types of messages about the relationship between race and genes. For many Americans, mass media has proven to be an important source of information about scientific studies and new medical technologies (Loo, Byrne, Hardin, Castro and Fisher, 1998; Moynihan et al., 2000; National Health Council, 1997; Sitthe-amorn and Ngamvithyapongse, 1998; Zaller, 1992). Media coverage has also been shown to increase the importance of various topics in the public's mind, although the evidence regarding whether mass media can substantively influence public attitudes about a topic is mixed (Fiske, 1987; Gerbner, Gross, Morgan & Signorielli, 1980; McCombs & Shaw, 1972). This chapter seeks to evaluate the extent to which varying mass media messages about the relationship between race and genes affects RBM-related beliefs and attitudes.

There have been several mass media studies that examined news media coverage of race and genetics. One mass media study showed that a substantial portion of newspaper articles present both the position that there is a genetic basis to race and that race is a social construct (Lynch & Condit, 2006). However, these articles tended to be slanted in one of the two directions, and predominately towards the "race is genetic" direction. Meanwhile, Phelan et al. (2013) in their analysis of newspaper articles about race and genetics generally, and race, genetics and health specifically, found that race and genetics articles that focused on health issues were significantly less likely to mention racism or discuss ethical issues than articles that were not focused on health. In addition, articles that discussed health were presented in much more positive terms (endorsing genetic causes of race-specific health differences) than articles that did not discuss health.

Several studies examining mass media's influence on beliefs about race and genetics generally, and race, genetics and health specifically, found that messages linking race, genes and health increased racist attitudes (Condit et al, 2004; Lynch et al., 2008; Parrott et al., 2005; Phelan, Link and Feldman, 2013). Such evidence suggests the possibility that how race and genes are discussed in the news could also influence seemingly more innocuous beliefs and attitudes such as beliefs regarding the relationship between race and health-related applications like RBM, as well as attitudes towards using RBM.

Exposing the lay public to varying messages about the relationship between race and genes, however, may not be enough to influence beliefs and attitudes regarding RBM. The extent to which the public accepts or rejects these messages may also be a factor influencing RBM-related beliefs and attitudes. McQuail (1979), in his analysis of mass media's effects on

public opinions, contends that subject matter that is unfamiliar or novel and less defined by prior conceptions and personal experiences will be more successful at shaping the public's beliefs and attitudes than subject matter that is more familiar. This suggests that messages in the form of mock news articles about race and genes have the potential to shape conceptions of race and, in turn, RBM-related conceptions, if it is subject matter with which an individual has little to no familiarity. However, Zaller's (1992) research on the effects of mass media on political campaigns shows that the public tends to resist arguments that are inconsistent with their own political predispositions. Therefore, if the individual has some familiarity or specific opinions about the subject, in this case, conceptions of race and racial differences, then the extent to which one is likely to accept a mock news article's message on this topic may have to do with the extent to which that message is consistent with his or her own beliefs about race and causes of racial differences.

To date, there is little research examining mass media's influence on RBM-related beliefs and attitudes. One study of lay focus group participants responding to public messages about race-specific medications indicated that some of the lay public may be skeptical about messages that link race to genetics and health (Bates et al., 2004). However, no study has examined the effects of varying mass media messages about the relationship between race and genetics on RBM-specific beliefs and attitudes. Therefore, the following is an analysis of findings from a vignette experiment examining the effects of mock news articles about different types of relationships between race and genes on RBM-related beliefs and attitudes. This *race vignette experiment* comprises five conditions. Respondents were randomized either to read one of four different vignettes that varied in their message about the relationship between race and genes or were assigned to a control condition that did not receive a vignette. As described on p. 56 in

Chapter 3, the vignettes were mock news articles with one of the following four messages: there is a genetic basis to race (a.k.a., the *race is genetic* vignette); racial categories are socially produced with no genetic basis (a.k.a., the *social construction* vignette); there are genetic markers for race but tests show most people are of mixed genetic ancestry (a.k.a., the *admixture* vignette); or, a gene has been found that disproportionately raises the risk of a heart attack among African Americans (a.k.a.. the *genetic health difference* vignette).

Aim 4 examines the effects of this vignette experiment on RBM-related beliefs and attitudes. The hypotheses developed for this aim, which are described in detail on pp. 64-66 in Chapter 3, contend that the vignette experiment differentially affected beliefs about whether there is a genetic basis to race, in turn influencing beliefs and attitudes regarding RBM's effectiveness and preferences for using RBM. The following are Aim 4's hypotheses:

> ***Hypothesis 4a*:** There will be no significant difference in endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes between the *race is genetic* and *genetic health difference* vignettes.

> ***Hypothesis 4b***: The *race is genetic* and *genetic health difference* vignettes will be associated with greater endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes than the *admixture* vignette.

***Hypothesis 4c*:** There will be no significant difference for RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes between the *social construction* vignette and control condition.

Hypothesis 4d: The *admixture* vignette will be associated with greater endorsement of RBM individual-level effectiveness, behavioral orientation and population effectiveness beliefs and attitudes than the *social construction* vignette and the control condition.

Hypothesis 4e: The *race is genetic* and *genetic health difference* vignettes will be associated with greater endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness than the *social construction* vignette or the control condition.

Aim 4's hypotheses predict that the *race is genetic* and *genetic health difference* vignettes would be the most likely to increase the belief that there is a genetic basis to race, and would thereby be associated with higher endorsement levels of RBM-related beliefs and attitudes. They also predict that the *social construction* vignette and control condition are less likely to be associated with the belief that there is a genetic basis to race and therefore would be associated with lower endorsement levels of RBM-related beliefs and attitudes. Because the *admixture* vignette message has the potential to influence opposing beliefs regarding whether there is a genetic basis to race, Aim 4's hypotheses predict that the *admixture* vignette would be associated with RBM-related beliefs and attitudinal endorsement levels that are somewhere between those of the predicted levels for the *race is genetic*/*genetic health difference* vignettes and the *social construction* vignette/control condition.

Aim 5 examines the extent to which acceptance or rejection of the assigned vignette's message moderates the relationship between vignette received and RBM-related beliefs and attitudes. The following are Aim 5's hypotheses:

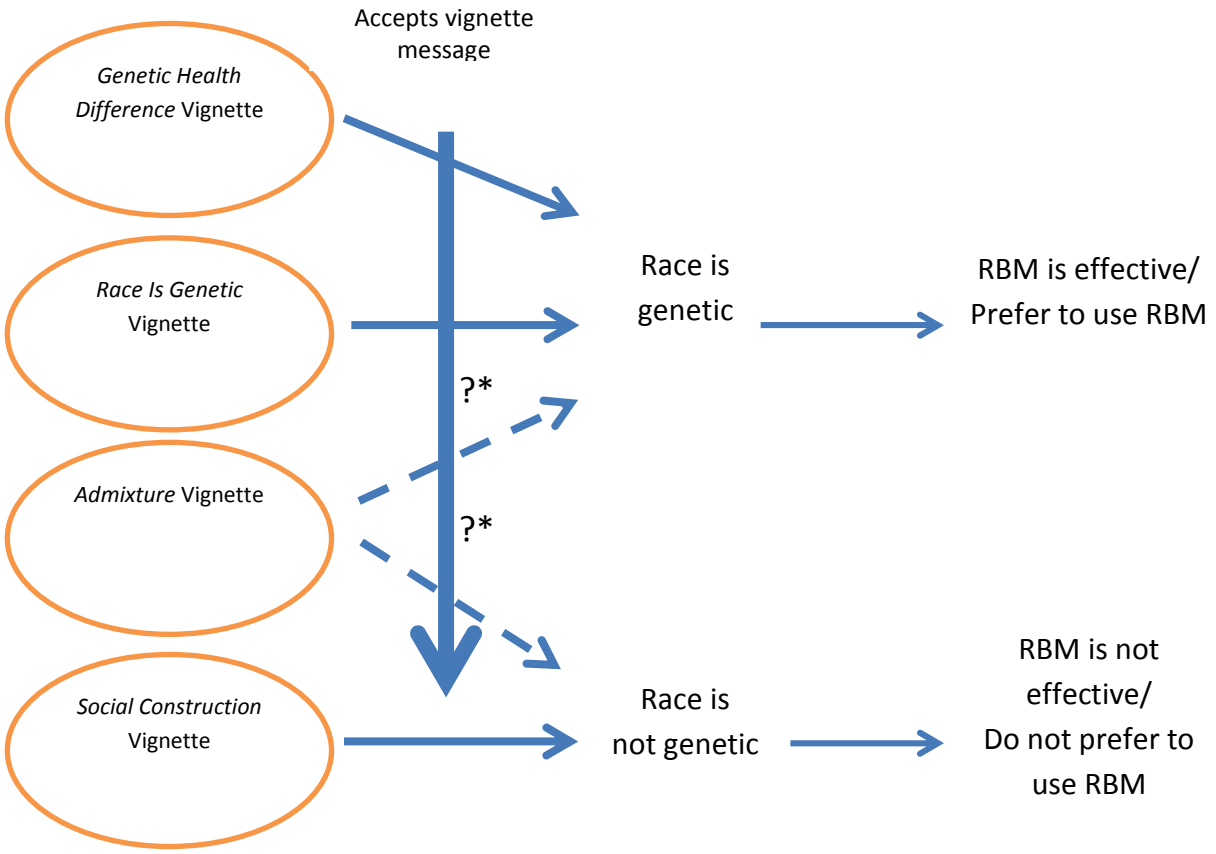
Hypothesis 5a: There will be a significant difference between the *social construction* and *race is genetic* vignettes in the association between vignette acceptance and RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes such that greater vignette acceptance will be associated with lower RBM belief levels for the *social construction* vignette while greater vignette acceptance will be associated with higher RBM belief levels for the *race is genetic* vignette.

Hypothesis 5b: There will not be a significant difference between the *genetic health difference* vignette and the *race is genetic vignette* in the association between vignette acceptance and RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes. Greater vignette acceptance should be associated with greater endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes for both vignettes.

Hypothesis 5c: There will be a significant difference between the *admixture* vignette and the *race is genetic* vignette in the association between vignette acceptance and RBM individual-level effectiveness, behavioral orientation and population-level effectiveness beliefs and attitudes. Greater acceptance of the *admixture* vignette will be associated with relatively lower endorsement of RBM individual-level effectiveness, behavioral

orientation and population-level effectiveness beliefs and attitudes while greater acceptance of the *race is genetic* vignette will be associated with higher endorsement of these attitudes and beliefs.

Note, Hypotheses 5a through 5c only test acceptance of each vignette in comparison to the *race is genetic* vignette. The hypotheses do not additionally test acceptance of the *social construction, admixture* and *genetic health difference* vignettes with each other. I decided to only test hypotheses that compare the *race is genetic* vignette with the other three vignette conditions because the *race is genetic* message continues to be a controversial and contested message, while the *social construction, admixture* and *genetic health difference* vignette messages do not (at least on the surface) appear to be controversial messages.



**Note*: Dashed lines from the *admixture* vignette indicate that the pathway to belief that race is or is not genetically-based is unclear, with the vignette possibly leading study participants in either direction.

Figure 5.1: Race vignette experiment flow chart of the hypothesized causal pathways from assigned vignette condition to beliefs about the relationship between race and genetics, to beliefs about RBM, accounting for vignette message acceptance.

Figure 5.1 is a chart of the hypothesized causal pathways flowing from the *race vignette experiment's* four vignette conditions to beliefs about the relationship between race and genes and, finally, to RBM-related beliefs and attitudes. The chart includes the hypothesized effect of vignette message acceptance on these causal pathways, suggesting that the hypothesized association between a vignette condition, race and genetics belief and RBM belief/attitude is predicated on acceptance of the vignette's message.

The following describes the research design and methods used to analyze the *race vignette experiment's* effects on RBM-related beliefs and attitudes. This is followed with a presentation of the results for Aims 4 and 5 and then a discussion of the findings.

5.2 Research Design and Methods

5.2.1 Sample

The sample used for Aims 4-5's analyses comprises 631 self-identified white and black adults aged 18 years of age or older who were randomized to the *race vignette experiment* (see pp. 60-63 in Chapter 3 for an in-depth description of this experiment). Only white and black respondents from the *race vignette experiment* were included in the sample because there were too few Hispanics, Asians and respondents self-identifying as "other" to be included in analyses examining racial similarities and differences in the RBM dependent variables within the vignette experiment.

Descriptive statistics for race, sex, education, income and age for each vignette condition in the sample are reported in Table 5.1. Respondents were randomized to the vignette conditions, thus, the socio-demographic characteristics for each vignette condition should be roughly comparable. ANOVA and Chi-square analyses were performed for each socio-demographic characteristic in order to assess whether there were any differences between vignette conditions. Table 5.1 shows that there were no significant differences between vignette conditions for race, sex, education and age. A comparison of the demographic characteristics for the vignette data compared with 2010 U.S. Census data shows that the sample participants

tended to be somewhat more educated than the U.S. population as a whole (U.S. Census Bureau, 2013).

Table 5.1: Descriptive statistics for Aims 4-5 sample (n_{TOTAL} = 631) by vignette condition and comparison with 2010 United States Census data for individuals aged 18 or older.

	Race is Genetic	Genetic Health Difference	Admixture	Social Construction	Control	2010 Census	Test for Differences
	(N = 133) N (%)	(N = 159) N (%)	(N = 121) N (%)	(N = 133) N (%)	(N = 85) N (%)	%	
Race							Chi-square
White	114 (86)	143 (90)	108 (89)	114 (86)	74 (87)	72.4 [a]	*p* = .889
Black	19 (14)	16 (10)	13 (11)	19 (14)	11 (13)	12.6	
Sex							Chi-square
Male	73 (55)	88 (55)	59 (49)	49 (37)	39 (46)	49.2	*p* = .110
Female	60 (45)	71 (45)	62 (51)	84 (63)	46 (54)	50.8	
Education [b]							ANOVA
<High School	4 (3)	23 (14)	9 (7)	8 (6)	0 (0)	12.9	*p* = .210
High School Degree or Equivalent	80 (60)	62 (39)	60 (50)	78 (59)	40 (47)	48.1	
Associates Degree	14 (11)	16 (10)	10 (8)	13 (10)	11 (13)	9.1	
Bachelors Degree	23 (17)	43 (27)	26 (21)	19 (14)	23 (27)	19.4	
Graduate Degree	12 (9)	15 (9)	13 (11)	14 (11)	11 (13)	10.5	
Age							ANOVA
18-44	66 (50)	76 (48)	45 (37)	47 (35)	32 (38)	48.1	*p* = .441
45-64	48 (36)	57 (36)	54 (45)	61 (46)	40 (47)	34.7	
65 & older	19 (14)	26 (16)	22 (18)	25 (19)	13 (15)	17.2	

[a] These percentages do not add up to 100 percent because they represent a percentage of the entire U.S. population, which includes individuals who self-identify as part of another racial group(s).

[b] Educational attainment is reported only for individuals aged 25 years or older, consistent with the U.S. Census's reporting of educational attainment for the adult population.

5.2.2 Measures

The primary independent variable for Aims 4-5 is *race vignette.* For this analysis, "dummy" variables were created. Dummy variables were created for all four vignettes to which respondents were randomized in this experiment – the *race is genetic, social construction, admixture*, and *genetic health difference* vignettes. The control condition was used as the referent category for the dummy variables except when indicated in analyses that did not involve the control condition. Although respondents were randomized to the vignette conditions, all multivariate analyses were controlled for race, sex, education and age in order to increase the precision of the estimates (see p. 94 in Chapter 3 for a complete description of the covariates).

The dependent variables that are analyzed in Aims 4-5 are the three RBM beliefs and attitude variables. They are: RBM individual-level effectiveness, RBM behavioral orientation, and RBM population-level effectiveness (see pp. 84-87 in Chapter 3 for an in-depth description of the three dependent variable measures).

In addition to the aforementioned independent and dependent variables, the analyses for Aim 4 include testing genetic essentialist beliefs in racial differences as a potential mediator of the *race vignette experiment's* effects on RBM beliefs and attitudes, if there is evidence to indicate that the vignette experiment overall had an effect on these dependent variables. A single item was used to measure genetic essentialist beliefs in racial differences (see p. 93 in Chapter 3 for a description of this measure). The analyses for Aim 5 include the vignette acceptance scale, which was analyzed as a potential moderator of vignette received in the examination of possible differences in RBM beliefs and attitudes based on assigned vignette condition. Two items were used to measure the extent to which respondents accepted the information that was provided in the vignette he or she had received and were converted into a scale based on the mean score of

the two items (see p. 93 in Chapter 3 for an in-depth description of the vignette acceptance scale).

5.2.3 Analyses

SPSS Version 21.0's Complex Sampling Module was used to perform the data analysis in order to estimate the correct standard errors for the survey data, which has a complex sampling design. Depending on the aim, means, multiple linear regression and $R^2_{Vignettes}$ analyses were used to assess each specific aim. The following is a description of the analyses for Aims 4-5.

Analysis of Aim 4. In this aim, I assessed whether mock news articles that discuss different types of relationships between race and genes impact RBM beliefs and attitudes. This aim was analyzed in several parts. First, I examined the means for RBM individual-level effectiveness, behavioral orientation and population-level effectiveness by vignette arm in order to assess the extent to which the vignettes' effects may have resulted in differences in the dependent variables. Because respondents were randomized to each vignette, presumably the potential impact of other variables did not account for any large differences between vignettes. Second, I examined to see if differences in RBM beliefs and attitudes arose between blacks and whites based on the *race vignette* condition to which they were assigned. This was done by regressing RBM individual-level effectiveness, behavioral orientation and population-level effectiveness on race, controlling for potential confounding effects of socio-demographic variables (sex, education and age). These regression analyses were done separately by *race vignette* condition (Table 5.2, Models 16-20).

Third, I constructed two multiple regression models to examine the *race vignette experiment's* overall effect on RBM beliefs and attitudes. The first model (No Vignettes model) only included all of the socio-demographic variables that are potentially associated with RBM beliefs and attitudes (Table 5.2, Model 21). Those variables in this model are race (whites and blacks only), sex, education and age. In the second model (Vignettes model), I added the vignette dummy variables – *race is genetic, social construction, admixture,* and *genetic health difference* – to the variables used in the No Vignettes model. I then compared the R^2 value for both models by subtracting the R^2 value for the No Vignettes model from R^2 for the Vignettes model to evaluate whether overall the vignettes had an effect on RBM individual-level effectiveness, behavioral orientation and population-level effectiveness. R^2 attributable to the vignettes was calculated as:

$$\mathbf{R^2\text{-change} = R^2_{Vignettes} - R^2_{No\ Vignettes}}$$

Fourth, *if the change in R^2 (i.e., R^2-change) indicated that the vignettes had an overall effect on RBM beliefs and attitudes, then I would test genetic essentialist beliefs in racial differences as a potential mediator of the vignette experiment's effect on RBM beliefs and attitudes.* To do this, I would follow Baron and Kenny's (1986) steps for testing mediators using multiple linear regression, where RBM individual-level effectiveness, behavioral orientation and/or population-level effectiveness would be regressed on the *race vignette experiment* dummy variables and the genetic essentialist beliefs in racial differences measure, controlling for race, sex, education and age (Table 5.2, Model 22).

Fifth, *if the change in R^2 (i.e., R^2-change) indicated that the vignettes had an overall effect on RBM beliefs and attitudes, then hypotheses 4a-4e, which test for individual vignettes'*

effects on the dependent variables, would also be tested. To do this, I would construct five different multiple regression models that only tested the effect on the dependent variables of those vignettes specified in a particular hypothesis. Table 5.2's Models 23-27 outline the variables used for Hypotheses 4a-4e. Note that the hypotheses are based on the causal pathways flow chart presented in Figure 5.1, which suggests that vignette received affects belief in a genetic basis to race, which in turn affects belief in RBM's effectiveness at the individual and population levels as well as preferences for using RBM.

In Hypothesis 4a, only the *race is genetic* versus the *genetic health difference* vignettes' effects on the dependent variables were examined, thus, a dummy variable for the two vignettes (*race is genetic* was the referent category) and the socio-demographic variables were included in the model.

For Hypothesis 4b, I created two dummy variables for the *race is genetic, genetic health difference* and *admixture* vignettes, setting the *admixture* vignette as the referent category. The RBM dependent variables will be regressed on the two dummy variables and the socio-demographic variables.

Hypothesis 4c required that I compare the *social construction* vignette with the no-vignette control condition. The effect of those two conditions on RBM beliefs and attitudes will be compared by creating a dummy variable with the control condition as the referent category and entering this dummy variable along with the socio-demographic variables in a multiple linear regression model.

For Hypothesis 4d, two dummy variables were created for the *social construction* vignette, *admixture* vignette, and no-vignette control condition using the *admixture* vignette as

the referent category. The *admixture* vignette will be set as the referent category because the hypothesis specifically compares that vignette to both the *social construction* vignette and the control condition. The RBM dependent variables will then be regressed on both dummy variables and the socio-demographic variables in order to compare the effect of the *admixture* vignette condition with the *social construction* and control conditions.

Hypothesis 4e, which hypothesizes that the *race is genetic* and *genetic health difference* vignettes are associated with greater endorsement of RBM beliefs and attitudes than the *social construction* vignette or the no-vignette control condition, will have three dummy variables created for the *race is genetic, genetic health difference* and *social construction* vignette conditions using the control condition as the referent category. The RBM dependent variables will be regressed on the dummy variables and socio-demographic control variables in order to compare each vignette's association with the dependent variables with each other.

All of the three aforementioned sets of analyses will be conducted on the total sample, as well as the white and black sub-samples.

Table 5.2: Variables used in Aims 4 and 5 multiple linear regression models.

Variable Types	Models 16-20	Model 21 ($R^2_{No\ Vignettes}$)	Model 21 ($R^2_{Vignettes}$)	Model 22	Models 23-27	Models 28-32	Models 33-35
Dependent Variables	RBM individual-level effectiveness, behavioral orientation and population-level effectiveness	RBM individual-level effectiveness, behavioral orientation and population-level effectiveness	RBM individual-level effectiveness, behavioral orientation and population-level effectiveness	RBM individual-level effectiveness, behavioral orientation and population-level effectiveness	RBM individual-level effectiveness, behavioral orientation and population-level effectiveness	RBM individual-level effectiveness, behavioral orientation and population-level effectiveness	RBM individual-level effectiveness, behavioral orientation and population-level effectiveness
Independent Variables	Race	Socio-demographic variables[b]	Vignettes	Vignettes	Different combinations of the vignettes	Vignette acceptance	Different combinations of the vignettes
Covariates	Socio-demographic variables [a]	--	Socio-demographic variables [b]	Socio-demographic variables [b]	Socio-demographic variables [b]	Socio-demographic variables [b]	Socio-demographic variables [b]
Mediator	--	--	--	Genetic essentialist beliefs in racial differences	--	--	--
Moderator	--	--	--	--	--	--	Vignette acceptance * vignettes

[a] The socio-demographic variables are sex, education and age.
[b] The socio-demographic variables are race (black/white), sex, education and age.

Analysis of Aim 5. In this aim, I assessed whether acceptance of the vignette modified the effect of the vignette received on RBM individual-level effectiveness, behavioral orientation and population-level effectiveness. Before testing vignette acceptance as a moderator, I first conducted an ANOVA analysis setting vignette acceptance as the covariate and vignette received as the factor. If the ANOVA indicated a significant association between vignette acceptance and vignette received, then I would go ahead and test vignette acceptance as a moderator.

Baron and Kenny (1986, p. 1175) contend that when the independent variable is categorical (in this case vignette received) and the tested moderator is continuous (in this case, the vignette acceptance scale), and it is assumed that the relationship between the independent variable (i.e., moderator) and dependent variable is linear, it is appropriate to use multiple linear regression to test to see if a variable is a moderator. As part of the process to test vignette acceptance as a moderator of the effects of the *race vignette experiment* on RBM beliefs and attitudes, multiple linear regression models (Table 5.2, Models 28-32) were first conducted to assess the association between the vignette acceptance scale and RBM-related beliefs and attitudes for each of the *race vignette* conditions. Three vignette dummy variables were then created to compare the *race is genetic* vignette with the *social construction, admixture* and *genetic health difference* vignette, with the *race is genetic* vignette condition serving as the referent category for all three dummy variables. The *race is genetic* vignette was compared with each of the remaining vignette conditions for Hypotheses 5a through 5c because I had proposed that this vignette would be the least accepted vignette of the four vignette conditions due to the controversial nature of the vignette's message.

The potential interaction between the vignette acceptance scale and each vignette dummy variable was then tested in separate models. RBM individual-level effectiveness, behavioral orientation and population-level effectiveness were separately regressed on the vignette dummy variable that was being tested, the vignette acceptance scale and the interaction term between these two variables (Table 5.2, Models 33-35). Each model was adjusted for race, sex, education and age. In addition to testing vignette acceptance as a moderator of vignette condition received for the RBM dependent variables, vignette acceptance frequencies were analyzed in order to assess relative vignette acceptance levels for each of the four vignette conditions.

5.3 Results

5.3.1 Aim 4: Vignette Experiment's Effects on Race-Based Medicine Beliefs and Attitudes

5.3.1.1 Vignettes' Effects on Race-Based Medicine Individual-Level Effectiveness

Table 5.3 presents the means, standard errors and 95% confidence intervals for RBM individual-level effectiveness by vignette type and race. The means for RBM individual-level effectiveness for the total sample by vignette type did not vary by much, ranging from a low of 2.44 for the *social construction* vignette, to 2.53 for *race is genetic*, 2.54 for the control group, 2.56 for *admixture*, and 2.59 for *genetic health difference*. For just the white sub-sample, the means also varied little, ranging from a low of 2.46 for the *social construction* vignette to a high of 2.65 for the *admixture* vignette. The means for the black sample, however, were somewhat lower than those for the white sample and had greater variation, ranging from a low of 1.85 for the *admixture* vignette to 2.20 for *race is genetic,* 2.20 for *genetic health difference*, 2.37 for *social construction*, and 2.50 for the control group. Thus, while the mean for RBM individual-level effectiveness among the white sample was approximately the mid-point for the range of values regardless of vignette condition (mid-point being 2.5 on a scale of 1 to 4), for black respondents it seemed that exposure to any mock news article about race and genetics, regardless of how the relationship between the two are conveyed, lowered endorsement of RBM individual-level effectiveness belief. In addition, it is notable that the highest mean score for RBM individual-level effectiveness among white respondents was for those assigned to the *admixture* vignette, however, black respondents assigned to this same vignette condition were associated with the lowest mean score for this construct.

Figure 5.2 is a line chart presenting the mean scores for RBM individual-level effectiveness by vignette condition and race. The chart shows that the means do not seem to vary much by vignette condition for the total sample and white sub-sample, but the means for the black sub-sample are slightly lower for the *race is genetic* and *genetic health difference* vignette conditions and substantially lower for the *admixture* condition.

Table 5.3: Means, standard errors, and 95% confidence intervals for RBM individual-level effectiveness by vignette condition and race.

	Total	Whites	Blacks
Race Is Genetic			
n	133	114	19
Mean	2.53	2.58	2.20
SE	.068	0.73	.106
95% CI	(2.39, 2.66)	(2.44, 2.73)	(1.99, 2.41)
Social Construction			
n	133	114	19
Mean	2.44	2.46	2.37
SE	.062	.069	.131
95% CI	(2.32, 2.57)	(2.32, 2.59)	(2.11, 2.63)
Admixture			
n	120	107	11
Mean	2.56	2.65	1.85
SE	.082	.068	.314
95% CI	(2.40, 2.73)	(2.52, 2.79)	(1.22, 2.46)
Genetic Health Difference			
n	159	143	16
Mean	2.59	2.63	2.21
SE	.097	.100	.321
95% CI	(2.39, 2.79)	(2.43, 2.83)	(1.57, 2.84)
Control			
n	84	73	11
Mean	2.54	2.55	2.50
SE	.078	.088	.157
95% CI	(2.19, 2.81)	(2.39, 2.70)	(2.37, 2.72)

Figure 5.2: Line chart marking mean scores for RBM individual-level effectiveness by vignette condition and race.

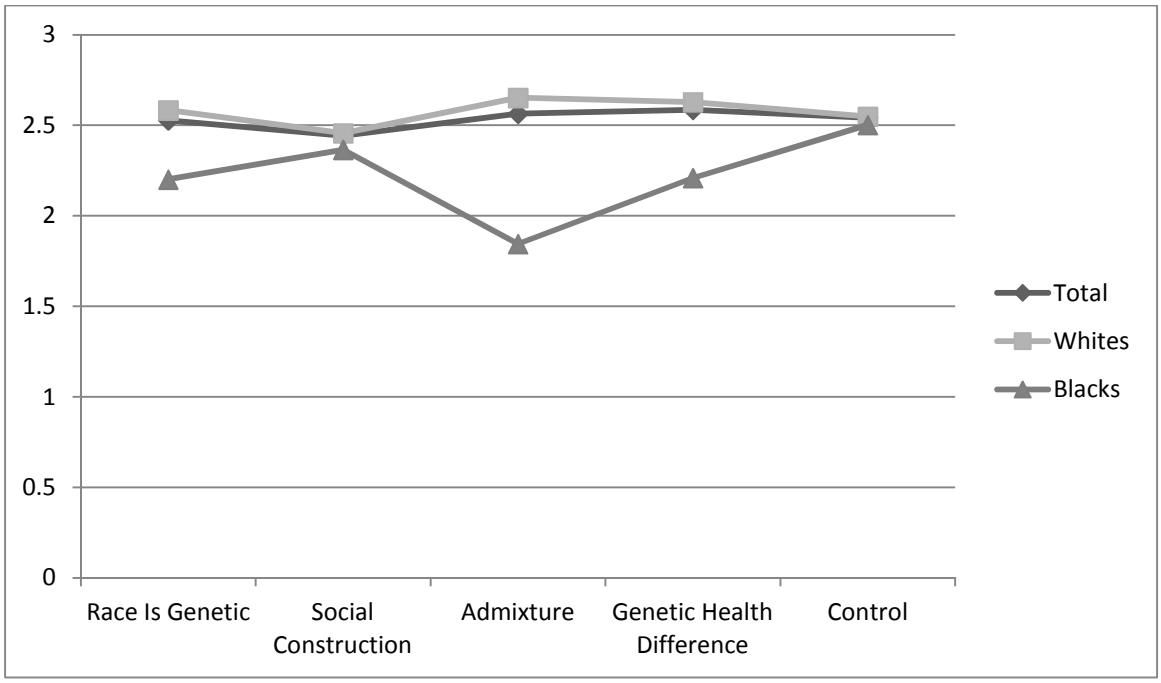


Table 5.4: Multiple linear regression estimates for RBM individual-level effectiveness regressed on race, adjusting for socio-demographic covariates, by vignette condition.

	Race Is Genetic Vignette	Social Construction Vignette	Admixture Vignette	Genetic Health Difference Vignette	Control Condition
	n = 133	n = 132	n = 118	n = 159	n = 83
	β (SE)	β (SE)	β (SE)	β (SE)	β (SE)
Intercept	1.160**	2.949***	2.127***	1.508*	1.932**
	(.394)	(.447)	(.524)	(.585)	(.616)
Black	-.274*	-.021	-.791**	-.493	-.028
	(.118)	(.152)	(.299)	(.350)	(.182)
Sex	.184	.147	.166	-.084	.053
	(.125)	(.136)	(.144)	(.179)	(.156)
Education	.114**	-.011	.036	.062	.074
	(.037)	(.040)	(.042)	(.051)	(.048)
Age	.003	-.009*	.002	.012*	-.004
	(.004)	(.004)	(.005)	(.005)	(.004)

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Table 5.4 shows that whites and blacks assigned to the *race is genetic* and *admixture* vignette conditions significantly differed in their endorsement of RBM individual-level effectiveness. Blacks were significantly less likely than whites to endorse RBM individual-level effectiveness after exposure to either the *race is genetic* vignette ($p < .05$) or the *admixture* vignette ($p < .01$).

Table 5.5 shows the estimates, standard errors and R^2 values for the two RBM individual-level effectiveness regression models for the total sample. R^2_{Change} was then calculated to assess

whether the vignette experiment as a whole had an effect on RBM beliefs and attitudes for the total sample. R^2_{Change}'s *p*-value was >.10 for the two models, indicating that the vignette experiment as a whole did not have a statistically significant effect on RBM individual-level effectiveness belief for the total sample.

The *p*-value of R^2_{Change} was also calculated for both the white and black sub-samples for RBM individual-level effectiveness belief (see Tables 5.6 and 5.7 respectively). For both subsamples, R^2_{Change} was not statistically significant at the .05 level, indicating that the vignette experiment did not have an effect on RBM individual-level effectiveness belief among either the white or black sub-samples.

Table 5.5: Multiple linear regression estimates, standard errors, and R^2 for RBM individual-level effectiveness regressed on socio-demographic variables, with and without vignette variables for the total sample (n = 626).

	β_{NOVIG} [a]	SE_{NOVIG}	β_{VIG} [b]	SE_{VIG}
Intercept	1.955***	.261	1.955***	.279
Black	-.321**	.113	-.315**	.117
Sex	.060	.072	.049	.074
Education	.050*	.023	.049*	.023
Age	.001	.002	.002	.002
Race is Genetic	--	--	.006	.105
Social Construction	--	--	-.071	.108
Genetic Health Difference	--	--	.050	.126
Admixture	--	--	.033	.115
R^2 for model	.050		.054	

$^{\dagger}P < .10$, $^{*}P < .05$, $^{**}P < .01$, $^{***}P < .001$.

[a] "NOVIG" refers to multiple linear regression model without vignette dummy variables.

[b] "VIG" refers to multiple linear regression model with vignette dummy variables.

Table 5.6: Multiple linear regression estimates, standard errors, and R^2 for RBM individual-level effectiveness regressed on socio-demographic variables, with and without vignette variables for the white sample (n = 547)

	β_{NOVIG} [a]	SE_{NOVIG}	β_{VIG} [b]	SE_{VIG}
Intercept	2.115***	.275	2.078***	.295
Sex	.068	.076	.056	.078
Education	.033	.024	.032	.024
Age	.002	.003	.002	.003
Race is Genetic	--	--	.044	.116
Social Construction	--	--	-.071	.118
Genetic Health Difference	--	--	.095	.133
Admixture	--	--	.119	.116
R^2 for model	.014		.024	

$^{\dagger}P < .10$, $^{*}P < .05$, $^{**}P < .01$, $^{***}P < .001$.

[a] "NOVIG" refers to multiple linear regression model without vignette dummy variables.

[b] "VIG" refers to multiple linear regression model with vignette dummy variables.

Table 5.7: Multiple linear regression estimates, standard errors, and R^2 for RBM individual-level effectiveness regressed on socio-demographic variables, with and without vignette variables for the black sample (n = 79)

	β_{NOVIG} [a]	SE_{NOVIG}	β_{VIG} [b]	SE_{VIG}
Intercept	-.358	.690	.039	.618
Sex	.122	.183	.213	.196
Education	.271***	.069	.259***	.062
Age	-.033	.006	-.006	.006
Race is Genetic	--	--	-.241	.221
Social Construction	--	--	-.122	.240
Genetic Health Difference	--	--	-.164	.292
Admixture	--	--	-.539†	.297
R^2 for model	.236		.301	

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

[a] "NOVIG" refers to multiple linear regression model without vignette dummy variables.

[b] "VIG" refers to multiple linear regression model with vignette dummy variables.

The testing of genetic essentialist beliefs in racial differences as a mediator between the *race vignette experiment* and RBM individual-level effectiveness was contingent on R^2_{Change} being statistically significant, thereby indicating that the vignettes had an effect on RBM individual-level effectiveness belief. Because this was not the case, genetic essentialist beliefs in racial differences was not tested as a mediator. In addition, hypotheses 4a-4e are contingency

hypotheses that would only be tested if R^2_{Change} was statistically significant. Because R^2_{Change} was not statistically significant for the total sample, or even the white and black sub-samples, Hypotheses 4a-4e were not tested for RBM individual-level effectiveness belief. None of the models for the total sample, white or black sub-samples indicated statistically significant differences between any of the vignette conditions and the control condition, however, it is notable that the estimate for the *admixture* vignette dummy variable in the black sub-sample regression model indicated that black respondents who received the *admixture* vignette were less likely to endorse RBM individual-level effectiveness belief than those who were assigned to the control condition ($p < .10$).

5.3.1.2 Vignettes' Effects on Race-Based Medicine Behavioral Orientation

Table 5.8 shows the means, standard errors and 95% confidence intervals for RBM behavioral orientation by vignette type and race. For the total sample, the means for RBM behavioral orientation ranged from a low of 3.04 for the *admixture* vignette, to 3.07 for the *social construction* vignette, 3.08 for the *genetic health difference* vignette, 3.12 for the *race is genetic* vignette and 3.26 for the control condition. These means indicate that respondents on average preferred to use RBM regardless of the type of vignette they received.

The range of mean RBM behavioral orientation scores by vignette type was similar for the white sub-sample, ranging from a low of 3.11 for the *genetic health difference* vignette to a high of 3.26 for the control condition. However, the means show a different story for the black sub-sample. The RBM behavioral orientation mean for the black sub-sample's control condition was 3.22, which is similar to the mean for the control condition in the white sub-sample. But,

the means for the other four vignette conditions were lower, ranging from 2.14 for the *admixture* vignette to 2.55 for the *race is genetic* vignette, 2.72 for the *genetic health difference* vignette, and 2.79 for the *social construction* vignette.

Figure 5.3 is a line graph that shows the mean scores for RBM behavioral orientation by vignette type and race. The chart visually shows that the means for this construct do not seem to vary much by vignette type for the total sample or the white sub-sample, but it also shows that the means are slightly lower for the *race is genetic, social construction* and *genetic health difference* vignette conditions for the black sub-sample, and substantially lower for the *admixture* vignette condition.

Table 5.8: Means, standard errors, and 95% confidence intervals for RBM behavioral orientation by vignette condition and race.

	Total	Whites	Blacks
Race Is Genetic			
n	131	114	19
Mean	3.12	3.22	2.55
SE	.103	.105	.217
95% CI	(2.92, 3.32)	(3.01, 3.43)	(2.12, 2.98)
Social Construction			
n	133	114	19
Mean	3.07	3.12	2.79
SE	.088	.091	.271
95% CI	(2.90, 3.25)	(2.94, 3.30)	(2.25, 3.32)
Admixture			
n	120	107	11
Mean	3.04	3.15	2.14
SE	.112	.090	.476
95% CI	(2.82, 3.26)	(2.97, 3.33)	(1.20, 3.08)
Genetic Health Difference			
n	158	142	16
Mean	3.08	3.11	2.72
SE	.127	.131	.424
95% CI	(2.12, 2.98)	(2.85, 3.37)	(1.89, 3.56)
Control			
n	82	71	11
Mean	3.26	3.26	3.22
SE	.106	.112	.308
95% CI	(3.04, 3.47)	(3.04, 3.48)	(2.61, 3.84)

Figure 5.3: Line chart marking mean scores for RBM behavioral orientation by vignette condition and race.

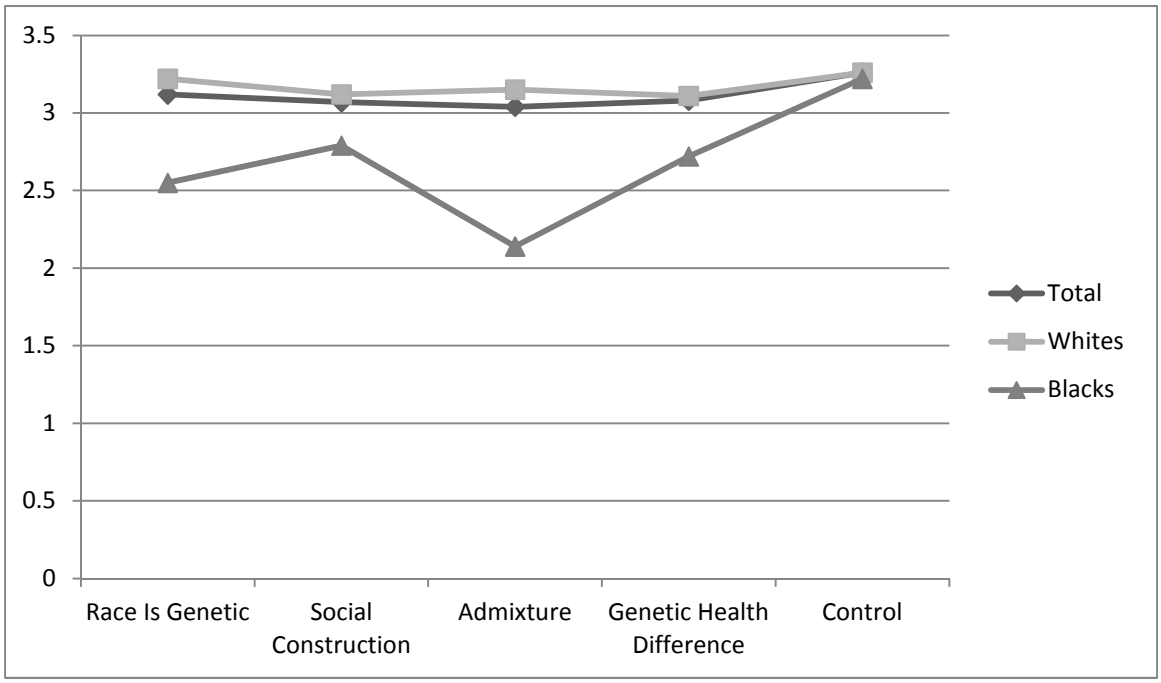


Table 5.9: Multiple linear regression estimates for RBM behavioral orientation regressed on race, adjusting for socio-demographic covariates, by vignette condition.

	Race Is Genetic Vignette n = 132 β (SE)	Social Construction Vignette n = 132 β (SE)	Admixture Vignette n = 118 β (SE)	Genetic Health Difference Vignette n = 158 β (SE)	Control Condition n = 82 β (SE)
Intercept	3.010***	3.747***	2.509***	2.921**	3.115**
	(.677)	(.557)	(.688)	(.847)	(.878)
Black	-.664*	-.228	-.986*	-.411	-.069
	(.268)	(.291)	(.429)	(.451)	(.348)
Sex	.093	.361†	.342†	.062	.124
	(.200)	(.190)	(.188)	(.254)	(.205)
Education	.012	-.076	.008	.002	.042
	(.058)	(.046)	(.056)	(.073)	(.071)
Age	.001	.000	.008	.003	-.008
	(.007)	(.006)	(.006)	(.007)	(.006)

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Table 5.9 shows that blacks and whites assigned to the *race is genetic* and *admixture* vignettes significantly differed in their endorsement of RBM behavioral orientation. Just like the results for RBM individual-level effectiveness, blacks were significantly less likely than whites to prefer to use RBM following exposure to either the *race is genetic* vignette ($p < .05$) or the *admixture* vignette ($p < .05$).

In order to examine whether the vignettes as a group had an overall effect on mean endorsement levels for RBM behavioral orientation among the sample as a whole, as well among the white and black sub-samples, R^2_{Change} was assessed once again for the two multiple linear regression models. Table 5.10 shows the estimates, standard errors and R^2 values for the two regression models. R^2_{Change}'s *p*-value was >.10 for the two models, indicating that the vignette experiment as a whole did not have a statistically significant effect on RBM behavioral orientation for the total sample.

The statistical significance of R^2_{Change} was also calculated for both the white and black sub-samples for RBM behavioral orientation (see Tables 5.11 and 5.12 respectively). For both sub-samples, R^2_{Change} was not statistically significant at the .05 level, indicating that the vignette experiment as a whole did not have an effect on RBM behavioral orientation among either the white or black respondents.

Table 5.10: Multiple linear regression estimates, standard errors, and R^2 for RBM Behavioral Orientation regressed on socio-demographic variables, with and without vignette variables for the total sample (n = 626)

	β_{NOVIG} [a]	SE_{NOVIG}	β_{VIG} [b]	SE_{VIG}
Intercept	2.953***	.339	3.158***	.361
Black	-.483**	.173	-.492**	.172
Sex	.142	.098	.145	.100
Education	.005	.030	.001	.030
Age	.002	.003	.002	.003
Race is Genetic	--	--	-.138	.145
Social Construction	--	--	-.166	.141
Genetic Health Difference	--	--	-.206	.165
Admixture	--	--	-.233	.149
R^2 for model	.042		.048	

$^{\dagger}P < .10$, $^{*}P < .05$, $^{**}P < .01$, $^{***}P < .001$.

[a] "NOVIG" refers to multiple linear regression model without vignette dummy variables.

[b] "VIG" refers to multiple linear regression model with vignette dummy variables.

Table 5.11: Multiple linear regression estimates, standard errors, and R^2 for RBM behavioral orientation regressed on socio-demographic variables, with and without vignette variables for the white sample (n = 542).

	β_{NOVIG} [a]	SE_{NOVIG}	β_{VIG} [b]	SE_{VIG}
Intercept	3.169***	.349	3.320***	.379
Sex	.180†	.101	.181†	.103
Education	-.019	.030	-.022	.031
Age	.002	.003	.002	.003
Race is Genetic	--	--	-.060	.155
Social Construction	--	--	-.142	.150
Genetic Health Difference	--	--	-.164	.171
Admixture	--	--	-.120	.146
R^2 for model	.014		.018	

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

[a] "NOVIG" refers to multiple linear regression model without vignette dummy variables.

[b] "VIG" refers to multiple linear regression model with vignette dummy variables.

Table 5.12: Multiple linear regression estimates, standard errors, and R^2 for RBM behavioral orientation regressed on socio-demographic variables, with and without vignette variables for the black sample (n = 79).

	β_{NOVIG} [a]	SE_{NOVIG}	β_{VIG} [b]	SE_{VIG}
Intercept	-.166	1.063	.519	.859
Sex	.017	.284	.117	.323
Education	.298***	.104	.284**	.086
Age	-.003	.009	-.005	.010
Race is Genetic	--	--	-.584	.354
Social Construction	--	--	-.466	.417
Genetic Health Difference	--	--	-.367	.454
Admixture	--	--	-.999*	.457
R^2 for model	.139		.221	

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

[a] "NOVIG" refers to multiple linear regression model without vignette dummy variables.

[b] "VIG" refers to multiple linear regression model with vignette dummy variables.

The testing of genetic essentialist beliefs in racial differences as a mediator between the *race vignette experiment* and RBM behavioral orientation was contingent on R^2_{Change} being statistically significant, thereby indicating that the vignettes had an effect on RBM behavioral orientation. Because this was not the case, genetic essentialist beliefs in racial differences was not tested as a mediator. In addition, hypotheses 4a-4e are contingency hypotheses that would

only be tested if R^2_{Change} was statistically significant. Because R^2_{Change} was not statistically significant for the total sample, or even the white and black sub-samples, Hypotheses 4a-4e were not tested for RBM behavioral orientation. It should be noted that although none of the vignettes were significantly different from the control condition in RBM behavioral orientation among the total sample and white sub-sample, some differences were seen among the black sub-sample. All of the vignettes seemed to be associated with lower RBM behavioral orientation means compared to the control condition, although only the estimate for the *admixture* vignette dummy variable was statistically significant ($p < .05$).

5.3.1.3 Vignettes' Effects on Race-Based Medicine Population-Level Effectiveness

Table 5.13 presents the means, standard errors and 95% confidence intervals for RBM population-level effectiveness belief by vignette type and race. For the total sample, the means for RBM population-level effectiveness ranged from a low of 2.27 for the control group, to 2.28 for the *admixture* vignette, 2.29 for the *genetic health difference* vignette, 2.39 for the *social construction* vignette and 2.42 for the *race is genetic* vignette. Once again, the RBM population-level effectiveness means by vignette type for the white sub-sample are similar to those for the total sample. For the white sub-sample the means ranged from a low of 2.24 for the control group, to 2.34 for the *genetic health difference* vignette, 2.37 for the *admixture* vignette, 2.41 for the *social construction* vignette, to 2.45 for the *race is genetic* vignette. However, again, the RBM population-level effectiveness means by vignette type were somewhat different for the black sub-sample. These means ranged from a low of 1.60 for the *admixture* vignette, to 1.86 for the *genetic health difference* vignette, 2.25 for the *social construction* vignette, 2.26 for the

race is genetic vignette to 2.48 for the control group. Notably, the means for RBM population-level effectiveness among black respondents randomized to the *admixture* and *genetic health difference* vignettes indicated that blacks somewhat to strongly disagreed with the belief that RBM would mitigate health inequalities following exposure to one of those two vignette messages.

Figure 5.4 is a line chart presenting the mean scores for RBM population-level effectiveness by vignette condition and race. The chart shows, once again, that the means did not vary much by vignette condition for the total sample and white sub-sample. The black sub-sample's means were slightly lower for the *genetic health difference* vignette condition, substantially lower for the *admixture* vignette condition, and slightly higher for the control condition, compared with those of the white sub-sample.

Table 5.13: Means, standard errors, and 95% confidence intervals for RBM population-level effectiveness by vignette condition and race.

	Total	Whites	Blacks
Race Is Genetic			
n	133	114	19
Mean	2.42	2.45	2.26
SE	.097	.106	.238
95% CI	(2.23, 2.61)	(2.24, 2.66)	(1.79, 2.73)
Social Construction			
n	133	114	19
Mean	2.39	2.41	2.25
SE	.108	.107	.405
95% CI	(2.18, 2.60)	(2.20, 2.62)	(1.45, 3.05)
Admixture			
n	119	106	13
Mean	2.28	2.37	1.60
SE	.104	.104	.288
95% CI	(2.08, 2.49)	(2.16, 2.57)	(1.03, 2.17)
Genetic Health Difference			
n	159	143	16
Mean	2.29	2.34	1.86
SE	.115	.122	.280
95% CI	(2.06, 2.52)	(2.10, 2.58)	(1.30, 2.41)
Control			
n	81	71	11
Mean	2.27	2.24	2.48
SE	.112	.114	.400
95% CI	(2.04, 2.49)	(2.01, 2.47)	(1.63, 3.22)

Figure 5.4: Line chart marking mean scores for RBM population-level effectiveness by vignette condition and race.

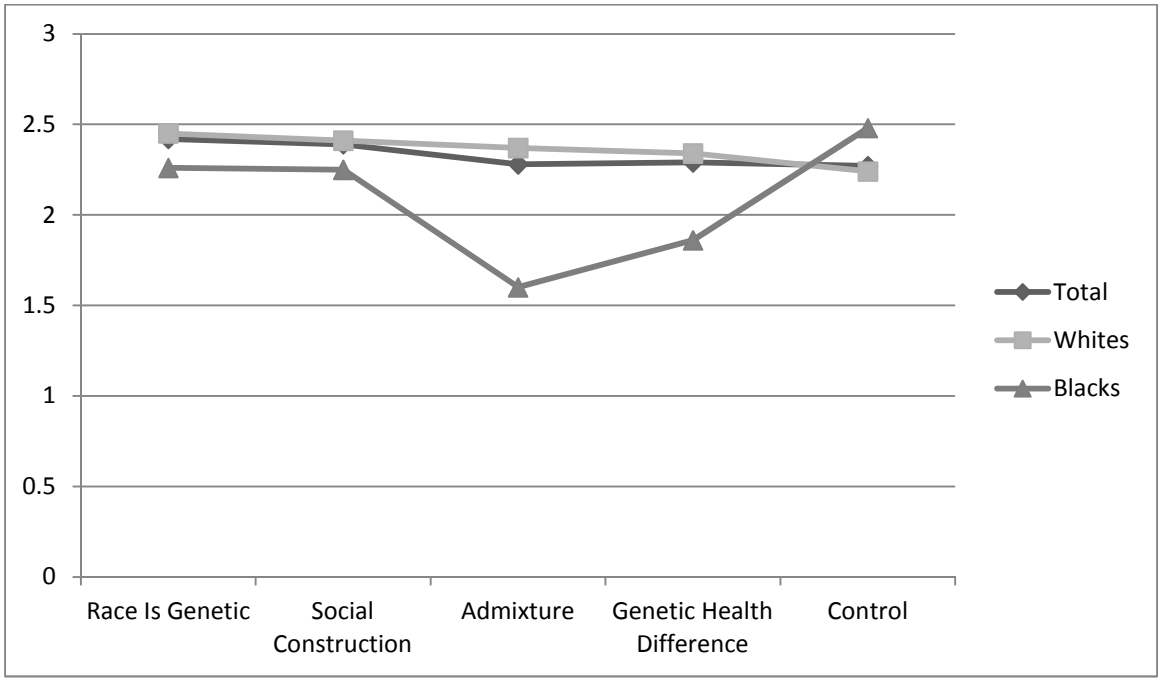


Table 5.14: Multiple linear regression estimates for RBM population-level effectiveness regressed on race, adjusting for socio-demographic covariates, by vignette condition.

	Race Is Genetic Vignette	Social Construction Vignette	Admixture Vignette	Genetic Health Difference Vignette	Control Condition
	n = 133	**n = 132**	**n = 117**	**n = 159**	**n = 81**
	β (SE)	**β (SE)**	**β (SE)**	**β (SE)**	**β (SE)**
Intercept	3.230***	-3.408***	1.518*	.938	3.126***
	(.809)	(.627)	(.718)	(.623)	(.613)
Black	-.281	-.090	-.672*	-.563†	.011
	(.278)	(.421)	(.304)	(.312)	(.360)
Sex	.142	.242	.058	-.269	-.037
	(.190)	(.223)	(.194)	(.201)	(.205)
Education	-.074	-.155*	.045	.092	-.012
	(.074)	(.061)	(.051)	(.058)	(.058)
Age	-.002	.010†	.007	.013*	-.015*
	(.006)	(.006)	(.007)	(.006)	(.006)

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$

Table 5.14 shows that black respondents were significantly less likely than white respondents to endorse RBM's effectiveness at reducing population-level health inequalities after exposure to the *admixture* vignette (p <.05). Although not significant at the .05-level, blacks also seemed to be less likely than whites to endorse RBM population-level effectiveness after exposure to the *genetic health difference* vignette.

Table 5.15: Multiple linear regression estimates, standard errors, and R^2 for RBM population-level effectiveness regressed on socio-demographic variables, with and without vignette variables for the total sample (n = 622)

	β_{NOVIG} [a]	SE_{NOVIG}	β_{VIG} [b]	SE_{VIG}
Intercept	2.289***	.377	2.221***	.396
Black	-.278	.173	-.286†	.169
Sex	-.020	.101	-.019	.101
Education	-.009	.032	-.007	.032
Age	.004	.003	.004	.003
Race is Genetic	--	--	.153	.156
Social Construction	--	--	.103	.163
Genetic Health Difference	--	--	.011	.162
Admixture	--	--	-.020	.156
R^2 for model	.016		.022	

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.
[a] "NOVIG" refers to multiple linear regression model without vignette dummy variables.
[b] "VIG" refers to multiple linear regression model with vignette dummy variables.

In order to examine whether the vignettes as a group had an overall effect on mean endorsement levels for RBM population-level effectiveness among the sample as a whole, as well as among the white and black sub-samples, R^2_{Change} was assessed once again. Table 5.15 shows the estimates, standard errors and R^2 values for the two regression models. R^2_{Change}'s *p*-value was >.10 for the two models, indicating that the vignette experiment as a whole did not have a statistically significant effect on RBM population-level effectiveness for the total sample.

The statistical significance of R^2_{Change} was also calculated for both the white and black sub-samples for RBM population-level effectiveness (see Tables 5.16. and 5.17 respectively).

For both sub-samples, R^2_{Change} was not statistically significant at the .05 level, indicating that the vignette experiment as a whole did not have an effect on RBM population-level effectiveness among either the white or black respondents.

Table 5.16: Multiple linear regression estimates, standard errors, and R^2 for RBM population-level effectiveness regressed on socio-demographic variables, with and without vignette variables for the white sample (n = 544)

	β_{NOVIG} [a]	SE_{NOVIG}	β_{VIG} [b]	SE_{VIG}
Intercept	2.384***	.399	2.237***	.427
Sex	.008	.107	.005	.107
Education	-.022	.034	-.019	.034
Age	.004	.004	.004	.004
Race is Genetic	--	--	.196	.161
Social Construction	--	--	.147	.165
Genetic Health Difference	--	--	.097	.168
Admixture	--	--	.090	.160
R^2 for model	.009		.013	

$^{\dagger}P < .10$, $^{*}P < .05$, $^{**}P < .01$, $^{***}P < .001$.

[a] "NOVIG" refers to multiple linear regression model without vignette dummy variables.

[b] "VIG" refers to multiple linear regression model with vignette dummy variables.

Table 5.17: Multiple linear regression estimates, standard errors, and R^2 for RBM population-level effectiveness regressed on socio-demographic variables, with and without vignette variables for the black sample (n = 79).

	β_{NOVIG} [a]	SE_{NOVIG}	β_{VIG} [b]	SE_{VIG}
Intercept	.714	1.128	1.092	1.106
Sex	-.108	.325	-.101	.337
Education	.157	.104	.138	.104
Age	-.003	.011	.000	.009
Race is Genetic	--	--	-.092	.469
Social Construction	--	--	-.253	.515
Genetic Health Difference	--	--	-.524	.474
Admixture	--	--	-.757	.465
R^2 for model	.046		.118	

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

[a] "NOVIG" refers to multiple linear regression model without vignette dummy variables.

[b] "VIG" refers to multiple linear regression model with vignette dummy variables.

The testing of genetic essentialist beliefs in racial differences as a mediator between the *race vignette experiment* and RBM population-level effectiveness was contingent on R^2_{Change} being statistically significant, thereby indicating that the vignettes had an effect on RBM population-level effectiveness belief. Once again, because this was not the case, genetic essentialist beliefs in racial differences was not tested as a mediator. In addition, hypotheses 4a-4e are contingency hypotheses that would only be tested if R^2_{Change} was statistically significant. Because R^2_{Change} was not statistically significant for the total sample, or the white and black sub-samples, Hypotheses 4a-4e were not tested for RBM population-level effectiveness belief.

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In sum, Aim 4's results indicate that the *race vignette experiment* did not have a statistically significant effect on RBM individual-level effectiveness, behavioral orientation or population-level effectiveness for the sample as a whole or by race. Because of the experiment's lack of overall effect, genetic essentialist beliefs in racial differences was not tested as a mediator, and Hypotheses 4a through 4e, which separately test each vignette condition's effect on RBM beliefs and attitudes, were not tested. There were, however, statistically significant differences between the white and black respondents for the *race is genetic* vignette's effect on RBM individual-level effectiveness and behavioral orientation, and for the *admixture* vignette's effect on all three RBM dependent variables.

5.3.2 Aim 5: Acceptance of Vignette and its Effects on Race-Based Medicine Beliefs and Attitudes

The purpose of Aim 5 is to assess the extent to which acceptance of the information provided in the vignette modified the relationship between the vignette received and RBM beliefs and attitudes. Exposure to one mock news article that discusses the relationship between race and genetics may not be enough to influence beliefs and attitudes about RBM. Instead, respondents' acceptance of the information provided in the vignette as true or plausible may be the more salient factor influencing RBM beliefs and attitudes as measured by this experiment.

I first conducted an ANOVA to see if there is a significant association between vignette received and the vignette acceptance scale. The association between the two variables was significant ($p < .001$), indicating that vignette acceptance has the potential to moderate the association between vignette received and each of the RBM-related dependent variables.

Table 5.18 presents frequencies for the range of values for the vignette acceptance scale for each of the experiment's vignette conditions, overall and by race. The table shows that relatively small proportions of respondents either somewhat-strongly rejected the message in the vignette they received – only 7.5 percent of total respondents assigned to the *social construction* vignette, 8.1 percent assigned to the *genetic health difference* vignette, 13.1 percent of respondents assigned to the *admixture* vignette, and 16.5 percent of respondents assigned to the *race is genetic* vignette either somewhat or strongly rejected the vignette's message. The greater difference in the vignette acceptance scale appeared to be in the proportion of respondents who somewhat or strongly accepted the vignette's message as accurate. While 73.7, 73.8 and 81.2 percent of the respective *admixture, genetic health difference* and *social construction* vignette respondents somewhat to strongly accepted the vignette's message as accurate, only 57.9 percent of the *race is genetic* vignette respondents indicated this belief.

Notably, there were some differences in vignette acceptance scale frequencies between white and black respondents assigned to each condition. Black respondents assigned to the *genetic health difference* vignette had relatively lower vignette acceptance levels than white respondents assigned to that condition (respectively 56.3 versus 75.5 percent). Black respondents also accepted the *social construction* vignette at a higher level than whites (89.5 versus 79.8 percent). Noticeably, exactly the same proportion of whites and blacks somewhat to strongly accepted the *race is genetic* vignette (57.9 percent of both sub-samples).

Table 5.18: Frequencies for vignette acceptance scale by vignette type and race.[a]

Vignette Acceptance Scale Values	Race is Genetic Frequencies (%)			Genetic Health Difference Frequencies (%)			Admixture Frequencies (%)			Social Construction Frequencies (%)		
	Total	**Whites**	**Blacks**	**Total**	**Whites**	**Blacks**	**Total**	**Whites**	**Blacks**	**Total**	**Whites**	**Blacks**
	n = 133	**n = 114**	**n = 19**	**n = 160**	**n = 144**	**n = 16**	**n = 122**	**n = 109**	**n = 13**	**n = 133**	**n = 114**	**n = 19**
Somewhat-Strongly Accept[b]	77 (57.9)	66 (57.9)	11 (57.9)	118 (73.8)	109 (75.7)	9 (56.3)	90 (73.7)	81 (74.3)	9 (69.2)	108 (81.2)	91 (79.9)	17 (89.5)
Neither Accept Nor Reject[c]	34 (25.6)	27 (23.7)	7 (36.8)	29 (18.1)	26 (18.1)	3 (18.8)	16 (13.1)	16 (14.7)	0 (0.0)	15 (11.3)	14 (12.3)	1 (5.3)
Somewhat-Strongly Reject[d]	22 (16.5)	21 (18.4)	1 (5.3)	13 (8.1)	9 (6.3)	4 (25.0)	16 (13.1)	12 (11.0)	4 (30.8)	10 (7.5)	9 (7.9)	1 (5.3)

[a] *P*-value = .000 for ANOVA to test for differences in vignette acceptance by vignette received for total sample (n = 548).
[b] Vignette acceptance scale range for this was 3.0-4.0.
[c] Vignette acceptance scale value for this was 2.5.
[d] Vignette acceptance scale range for this was 1.0-2.0.

The following are the results for Aim 5's hypotheses that propose that vignette acceptance moderates the relationship between vignette type and RBM beliefs and attitudes.

5.3.2.1 Acceptance of Vignette's Effect on RBM Individual-Level Effectiveness: Social Construction Versus Race is Genetic Vignettes

I proposed three hypotheses that separately compared the *social construction, genetic health difference* and *admixture* vignettes with the *race is genetic* vignette, testing to see if vignette acceptance moderates the relationship between vignette type and RBM individual-level effectiveness. Hypothesis 5a contends that there will be a significant difference between the *social construction* and *race is genetic* vignettes in the association between the vignette acceptance scale and RBM individual-level effectiveness. For the *social construction* vignette, higher vignette acceptance is hypothesized to be associated with lower endorsement of RBM individual-level effectiveness, but for the *race is genetic* vignette, higher vignette acceptance is hypothesized to be associated with greater endorsement of RBM individual-level effectiveness.

Hypothesis 5a was tested by regressing RBM individual-level effectiveness on the *social construction* dummy variable (with the *race is genetic* vignette as the referent category), vignette acceptance scale and the interaction term between the two variables. The multiple linear regression model was also adjusted for race, sex, education and age. Table 5.19 presents the estimates and standard errors for this regression model. The estimate for the interaction term between the *social construction* dummy variable and vignette acceptance scale indicates that vignette acceptance does in fact moderate the relationship between type of vignette received (*social construction* versus *race is genetic*) and RBM individual-level effectiveness ($\beta = -.381$, SE = .121, $p < .01$).

Table 5.19: Multiple linear regression estimates, standard errors, and R^2 for models examining vignette acceptance as moderator of *social construction* versus *race is genetic* vignettes on RBM individual-level effectiveness (n = 265).

	β	SE	β	SE
Intercept	1.536***	.340	.993**	.323
***Social Construction* Vignette**	-.129	.096	1.009**	.358
Black	-.233*	.103	-.220†	.113
Sex	.091	.095	.063	.094
Education	.052†	.027	.056*	.027
Age	-.002	.003	-.003	.003
Vignette Acceptance	.194**	.060	.389***	.078
***Social Construction* * Vignette Acceptance**	--	--	-.381**	.121
R^2 for model	.085		.118	

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Separate regression models were then conducted with the *social construction* vignette respondents and the *race is genetic* vignette respondents to assess their respective associations between the vignette acceptance scale and RBM individual-level effectiveness. Table 5.20 presents the results of these models. The vignette-specific regression models indicate that vignette acceptance was not associated with RBM individual-level effectiveness for respondents who received the *social construction* vignette, however, it was positively associated with RBM individual-level effectiveness for respondents who received the *race is genetic* vignette ($p <$ .001). Among the *race is genetic* vignette respondents, those who were more likely to accept the

idea that there is a genetic basis to race, as discussed in this mock news article, were also more likely to believe that RBM is effective at the individual level. Acceptance of the concept of race as being socially constructed, as described in the *social construction* vignette, seemed to have no association with RBM individual-level effectiveness belief. Hypothesis 5a contended, in part, that lower vignette acceptance would be associated with greater endorsement of RBM individual-level effectiveness among *social construction* vignette respondents, however, this was not the case. Despite the lack of support for this part of the hypothesis, the results indicate that vignette acceptance does moderate the relationship between type of vignette received and RBM individual-level effectiveness. Hypothesis 5a is therefore otherwise supported by the findings.

Table 5.20: Multiple linear regression estimates by vignette condition for RBM individual-level effectiveness regressed on the vignette acceptance scale.

	Race Is Genetic (n = 133)		Social Construction (n = 132)		Genetic Health Difference (n = 159)		Admixture (n = 118)	
	β	**SE**	**β**	**SE**	**β**	**SE**	**β**	**SE**
Intercept	.204	.372	2.975***	.479	1.395*	.587	2.412***	.529
Black	-.270†	.137	-.020	.153	-.476	.354	-.806**	.290
Sex	.114	.121	.146	.137	-.080	.176	.157	.143
Education	.117**	.038	-.011	.040	.061	.052	.039	.043
Age	.001	.004	-.009*	.004	.012*	.005	.002	.005
Vignette Acceptance	.367***	.070	-.008	.090	.038	.167	-.100	.110
R^2	.237		.063		.111		.169	

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

5.3.2.2 Acceptance of Vignette's Effect on RBM Individual-Level Effectiveness: Genetic Health Difference Versus Race is Genetic Vignettes

Hypothesis 5b contends that there will *not* be a significant difference between the *genetic health difference* and *race is genetic* vignettes. It was hypothesized that for both vignettes, greater vignette acceptance will be associated with greater RBM individual-level effectiveness belief. Table 5.21 shows that the interaction term for the *genetic health difference* dummy variable (with *race is genetic* as the referent category) and the vignette acceptance scale variable indicates that there may be differences in the association between vignette acceptance and RBM individual-level effectiveness for respondents who received the *genetic health difference* vignette when compared to those who received the *race is genetic* vignette (β = -.297, SE = .174, $p < .10$). This difference, however, was not statistically significant, thereby technically indicating support for Hypothesis 5b that there is no significant difference between the two vignettes in the association between vignette acceptance and RBM individual-level effectiveness.

The separate regression models examining the association between vignette acceptance and RBM individual-level effectiveness for the *genetic health difference* and *race is genetic* vignettes show that while vignette acceptance is significantly associated with RBM individual-level effectiveness for the *race is genetic* respondents, there was no association between the two for respondents assigned to the *genetic health difference* vignette. Therefore, although the interaction term between the vignette acceptance scale and the vignette dummy variable was not statistically significant, indicating support for Hypothesis 5b, the lack of association between vignette acceptance and RBM individual-level effectiveness for the *genetic health difference* vignette respondents also indicates that vignette acceptance may in fact moderate the relationship between vignette type and the dependent variable.

Table 5.21: Multiple linear regression estimates, standard errors, and R^2 for models examining vignette acceptance as moderator of *genetic health difference* versus *race is genetic* vignettes on RBM individual-level effectiveness (n = 292).

	β	SE	β	SE
Intercept	.869*	.393	.433	.405
***Genetic Health Difference* Vignette**	-.007	.110	.861†	.517
Black	-.295	.181	-.319†	.180
Sex	.037	.115	.018	.111
Education	.076*	.037	.076*	.037
Age	.007*	.004	.007†	.004
Vignette Acceptance	.200*	.101	.361***	.073
***Genetic Health Difference* * Vignette Acceptance**	--	--	-.297†	.174
R^2 for model	.127		.141	

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

5.3.2.3 Acceptance of Vignette's Effect on RBM Individual-Level Effectiveness: Admixture Versus Race is Genetic Vignettes

Hypothesis 5c contends that there will be a significant difference between the *admixture* and *race is genetic* vignettes in the association between vignette acceptance and RBM individual-level effectiveness. It proposes that greater acceptance of the *admixture* vignette will be associated with lower endorsement of RBM individual-level effectiveness, while greater acceptance of the *race is genetic* vignette will be associated with higher endorsement of RBM individual-level effectiveness. Table 5.22 presents the results of the multiple linear regression model testing vignette acceptance as a moderator of the association between vignette type and

RBM individual-level effectiveness. The estimate for the interaction term between vignette acceptance and the *admixture* vignette dummy variable (with the *race is genetic* vignette as the referent category) indicates that vignette acceptance does moderate the relationship between the two variables (β = -.458, SE = .130, $p < .001$).

Table 5.22: Multiple linear regression estimates, standard errors, and R^2 for models examining vignette acceptance as moderator of *admixture* versus *race is genetic* vignettes on RBM individual-level effectiveness (n = 251).

	β	SE	β	SE
Intercept	1.363***	.371	.694†	.399
***Admixture* Vignette**	-.006	.099	1.338***	.369
Black	-.494**	.171	-.505**	.169
Sex	.173†	.101	.138	.099
Education	.070*	.032	.074*	.033
Age	.002	.003	.001	.003
Vignette Acceptance	.125	.076	.363***	.074
***Admixture* * Vignette Acceptance**	--	--	-.458***	.130
R^2 for model	.140		.183	

†$P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$.

Separate regression models were then conducted with the *admixture* vignette respondents and the *race is genetic* vignette respondents to assess their respective associations between the vignette acceptance scale and RBM individual-level effectiveness. Table 5.20 presents the results of these models. The vignette-specific regression models indicate that vignette acceptance was not associated with RBM individual-level effectiveness for respondents who

received the *admixture* vignette, however, it was positively associated with RBM individual-level effectiveness for respondents who received the *race is genetic* vignette ($p < .001$). Among the *race is genetic* respondents, those who were more likely to accept the idea that there is a genetic basis to race, as discussed in this mock news article, were more likely to believe that RBM is effective at the individual level. Acceptance of the concept of racial admixture, as described in the *admixture* vignette, seemed to have no association with RBM individual-level effectiveness belief. Hypothesis 5c contended, in part, that lower vignette acceptance would be associated with greater endorsement of RBM individual-level effectiveness among *admixture* vignette respondents, however, this was not the case. Despite the lack of support for this part of the hypothesis, the results indicate that vignette acceptance does moderate the relationship between type of vignette received and RBM individual-level effectiveness for *admixture* versus *race is genetic* vignettes. Hypothesis 5c is therefore otherwise supported by the findings.

5.3.2.4 Acceptance of Vignette's Effect on RBM Behavioral Orientation: Social Construction Versus Race is Genetic Vignettes

Hypothesis 5a was tested for RBM behavioral orientation by regressing RBM behavioral orientation on the *social construction* dummy variable (with the *race is genetic* vignette as the referent category), vignette acceptance scale and the interaction term between the two variables. The multiple linear regression model was also adjusted for race, sex, education and age. Table 5.23 presents the estimates and standard errors for this regression model. The estimate for the interaction term between the *social construction* dummy variable and vignette acceptance scale indicates that vignette acceptance does in fact moderate the relationship between type of vignette

received (*social construction* versus *race is genetic*) and RBM behavioral orientation (β = -.510, SE = .184, $p < .01$).

Table 5.23: Multiple linear regression estimates, standard errors, and R^2 for models examining vignette acceptance as moderator of *social construction* versus *race is genetic* vignettes on RBM behavioral orientation (n = 264).

	β	SE	β	SE
Intercept	2.961***	.550	2.240***	.619
***Social Construction* Vignette**	-.065	.133	1.457*	.577
Black	-.500*	.194	-.481*	.185
Sex	.164	.142	.128	.142
Education	-.021	.035	-.016	.033
Age	.002	.004	.000	.004
Vignette Acceptance	.103	.090	.365**	.128
***Social Construction* * Vignette Acceptance**	--	--	-.510**	.184
R^2 for model	.054		.082	

†$P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$.

Separate regression models were then conducted with the *social construction* vignette respondents and the *race is genetic* vignette respondents to assess their respective associations between the vignette acceptance scale and RBM behavioral orientation. Table 5.24 presents the results of these models. The vignette-specific regression models indicate that vignette acceptance was not associated with RBM behavioral orientation for respondents who received the *social construction* vignette, however, it was positively associated with RBM behavioral

orientation for respondents who received the *race is genetic* vignette ($p < .01$). Among the *race is genetic* respondents, those who were more likely to accept the idea that there is a genetic basis to race, as discussed in this mock news article, were more likely to prefer to use RBM. Acceptance of the concept of race as being socially constructed, as described in the *social construction* vignette, seemed to have no association with preference for using RBM. Hypothesis 5a contended, in part, that lower vignette acceptance would be associated with greater preference for using RBM among *social construction* vignette respondents, however, this was not the case. Despite the lack of support for this part of the hypothesis, the results indicate that vignette acceptance does modify the relationship between type of vignette received and RBM behavioral orientation. Hypothesis 5a is therefore otherwise supported by the findings.

Table 5.24: Multiple linear regression estimates by vignette condition for the vignette acceptance scale regressed on RBM behavioral orientation.

	Race Is Genetic (n = 132)		Social Construction (n = 132)		Genetic Health Difference (n = 158)		Admixture (n = 118)	
	β	**SE**	**β**	**SE**	**β**	**SE**	**β**	**SE**
Intercept	2.028*	.815	4.198***	.705	2.847**	.946	2.553***	.665
Black	-.658**	.247	-.207	.283	-.400	.459	-.988*	.430
Sex	.024	.195	.350†	.192	.064	.243	.340†	.187
Education	.014	.052	-.072	.045	.002	.073	.008	.056
Age	-.001	.007	-.001	.006	.003	.007	.008	.006
Vignette Acceptance	.380**	.123	-.142	.127	.025	.199	-.015	.123
R^2	.120		.071		.020		.179	

$^{\dagger}P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$.

5.3.2.5 Acceptance of Vignette's Effect on RBM Behavioral Orientation: Genetic Health Difference Versus Race is Genetic Vignettes

Hypothesis 5b contends that there will *not* be a significant difference between the *genetic health difference* and *race is genetic* vignettes in the association between vignette acceptance and RBM behavioral orientation. It was hypothesized that for both vignettes, greater vignette acceptance will be associated with greater preference for using RBM. Table 5.25 shows that the interaction term for the *genetic health difference* dummy variable (with *race is genetic* as the referent category) and the vignette acceptance scale variable indicates that there is no significant difference in the association between vignette acceptance and RBM behavioral orientation for respondents who received the *genetic health difference* vignette when compared to those who received the *race is genetic* vignette (β = -.360, SE = .230, p = .120). The lack of significant difference between the two vignettes in the association between vignette acceptance and RBM behavioral orientation indicates support for Hypothesis 5b.

Notably, the separate regression models examining the association between vignette acceptance and RBM behavioral orientation for the *genetic health difference* and *race is genetic* vignettes show that while vignette acceptance is significantly associated with RBM behavioral orientation for the *race is genetic* respondents ($p < .01$), there was no association between the two for respondents assigned to the *genetic health difference* vignette. Therefore, although the interaction term between the vignette acceptance scale and the vignette dummy variable was not statistically significant, indicating support for Hypothesis 5b, the lack of association between vignette acceptance and RBM behavioral orientation for the *genetic health difference* vignette respondents also indicates that vignette acceptance may in fact moderate the relationship between vignette type and the dependent variable.

Table 5.25: Multiple linear regression estimates, standard errors, and R^2 for models examining vignette acceptance as moderator of *genetic health difference* versus *race is genetic* vignettes on RBM behavioral orientation (n = 290).

	β	SE	β	SE
Intercept	2.523***	.648	1.993**	.714
***Genetic Health Difference* Vignette**	-.118	.151	.936	.698
Black	-.500*	.251	-.529*	.241
Sex	.065	.167	.042	.161
Education	.005	.050	.005	.049
Age	.002	.005	.002	.005
Vignette Acceptance	.175	.132	.371**	.129
***Genetic Health Difference* * Vignette Acceptance**	--	--	-.360	.230
R^2 for model	.051		.063	

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

5.3.2.6 Acceptance of Vignette's Effect on RBM Behavioral Orientation: Admixture Versus Race is Genetic Vignettes

Hypothesis 5c contends that there will be a significant difference between the *admixture* and *race is genetic* vignettes in the association between vignette acceptance and RBM behavioral orientation. It proposes that greater acceptance of the *admixture* vignette will be associated with lower endorsement of RBM behavioral orientation, while greater acceptance of the *race is genetic* vignette will be associated with higher endorsement of RBM behavioral orientation. Table 5.26 presents the results of the multiple linear regression model testing vignette acceptance

as a moderator of the association between vignette type and RBM behavioral orientation. The estimate for the interaction term between vignette acceptance and the *admixture* vignette dummy variable (with the *race is genetic* vignette condition as the referent category) indicates that vignette acceptance does moderate the relationship between vignette received and RBM behavioral orientation (β = -.359, SE = .176, $p < .05$).

Table 5.26: Multiple linear regression estimates, standard errors, p-values and R^2 for models examining vignette acceptance as moderator of *admixture* versus *race is genetic* vignettes on RBM behavioral orientation (n = 250).

	β	SE	β	SE
Intercept	2.402***	.547	1.876**	.664
***Admixture* Vignette**	-.149	.137	.906†	.535
Black	-.778**	.265	-.786**	.258
Sex	.201	.144	.175	.142
Education	.010	.040	.013	.039
Age	.004	.005	.003	.005
Vignette Acceptance	.158	.100	.345**	.126
***Admixture* * Vignette Acceptance**	--	--	-.359*	.176
R^2 for model	.117		.131	

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Separate regression models were then conducted with the *admixture* vignette respondents and the *race is genetic* vignette respondents to assess their respective associations between the vignette acceptance scale and RBM behavioral orientation. Table 5.24 presents the results of these models. The vignette-specific regression models indicate that vignette acceptance was not

associated with RBM behavioral orientation for respondents who received the *admixture* vignette, however, it was positively associated with RBM behavioral orientation for respondents who received the *race is genetic* vignette ($p < .01$). Among the *race is genetic* respondents, those who were more likely to accept the idea that there is a genetic basis to race, as discussed in this mock news article, were more likely to prefer to use RBM. Acceptance of the concept of racial admixture, as described in the *admixture* vignette, seemed to have no association with preference for using RBM. Hypothesis 5c contended, in part, that lower vignette acceptance would be associated with greater preference for using RBM among *admixture* vignette respondents, however, this was not the case. Despite the lack of support for this part of the hypothesis, the results indicate that vignette acceptance does modify the relationship between type of vignette received and RBM behavioral orientation for *admixture* versus *race is genetic* vignette types. Hypothesis 5c is therefore supported by the findings.

5.3.2.7 Acceptance of Vignette's Effect on RBM Population-Level Effectiveness: Social Construction Versus Race is Genetic Vignettes

Hypothesis 5a was tested for RBM population-level effectiveness by regressing RBM population-level effectiveness on the *social construction* dummy variable (with the *race is genetic* vignette as the referent category), vignette acceptance scale and the interaction term between the two variables. The multiple linear regression model was also adjusted for race, sex, education and age. Table 5.27 presents the estimates and standard errors for this regression model. The estimate for the interaction term between the *social construction* dummy variable and vignette acceptance scale indicates that vignette acceptance does in fact moderate the

relationship between type of vignette received (*social construction* versus *race is genetic*) and RBM population-level effectiveness (β = -.569, SE = .212, $p < .01$).

Table 5.27: Multiple linear regression estimates, standard errors, and R^2 for models examining vignette acceptance as moderator of *social construction* versus *race is genetic* vignettes on RBM population-level effectiveness (n = 265).

	β	SE	β	SE
Intercept	2.941***	.545	2.131***	.549
***Social Construction* Vignette**	-.081	.144	1.615*	.654
Black	-.190	.254	-.170	.239
Sex	.171	.144	.128	.141
Education	-.113*	.044	-.107*	.042
Age	.004	.004	.003	.004
Vignette Acceptance	.135	.107	.431**	.123
***Social Construction* * Vignette Acceptance**	--	--	-.569**	.212
R^2 for model	.052		.084	

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Separate regression models were then conducted with the *social construction* vignette respondents and the *race is genetic* vignette respondents to assess their respective associations between the vignette acceptance scale and RBM population-level effectiveness. Table 5.28 presents the results of these models. The vignette-specific regression models indicate that vignette acceptance was not associated with RBM population-level effectiveness for respondents

who received the *social construction* vignette, however, it was positively associated with RBM population-level effectiveness for respondents who received the *race is genetic* vignette ($p <$ .001). Among the *race is genetic* respondents, those who were more likely to accept the idea that there is a genetic basis to race, as discussed in this mock news article, were more likely to believe that RBM could be effective at reducing health inequalities. Acceptance of the concept of race as being socially constructed, as described in the *social construction* vignette, seemed to have no association with belief regarding RBM's effectiveness at the population level. Hypothesis 5a contended that lower vignette acceptance would be associated with endorsement of RBM population-level effectiveness among *social construction* vignette respondents, however, this was not the case. Despite the lack of support for this part of the hypothesis, the results indicate that vignette acceptance does moderate the relationship between type of vignette received and RBM population-level effectiveness. Hypothesis 5a is therefore supported by the findings.

Table 5.28: Multiple linear regression estimates by vignette condition for the vignette acceptance scale regressed on RBM population-level effectiveness.

	Race Is Genetic (n = 133)		Social Construction (n = 132)		Genetic Health Difference (n = 159)		Admixture (n = 117)	
	β	**SE**	**β**	**SE**	**β**	**SE**	**β**	**SE**
Intercept	2.070**	.761	3.754***	.744	.884	.767	2.199**	.679
Black	-.276	.237	-.074	.409	-.555†	.305	-.709*	.281
Sex	.050	.171	.231	.225	-.267	.197	.036	.185
Education	-.074	.066	-.152*	.061	.091	.059	.052	.047
Age	-.004	.005	.009	.006	.013*	.006	.007	.006
Vignette Acceptance	.463***	.126	-.110	.171	.019	.186	-.238†	.126
R^2	.117		.088		.129		.149	

†*P* < .10, **P* < .05, ***P* < .01, ****P* < .001.

5.3.2.8 Acceptance of Vignette's Effect on RBM Population-Level Effectiveness: Genetic Health Difference Versus Race is Genetic Vignettes

Hypothesis 5b contends that there will *not* be a significant difference between the *genetic health difference* and *race is genetic* vignettes in the association between vignette acceptance and RBM population-level effectiveness. It was hypothesized that for both vignettes, greater vignette acceptance will be associated with greater endorsement of the belief that RBM would be

effective at reducing health inequalities. Table 5.29 shows that the interaction term for the *genetic health difference* dummy variable (with *race is genetic* as the referent category) and the vignette acceptance scale variable indicates that there is no significant difference in the association between vignette acceptance and RBM population-level effectiveness for respondents who received the *genetic health difference* vignette when compared to those who received the *race is genetic* vignette (β = -.372, SE = .229, p = .106). The lack of significant difference between the two vignettes in the association between vignette acceptance and RBM population-level effectiveness indicates support for Hypothesis 5b.

Once again, notably, the separate regression models examining the association between vignette acceptance and RBM population-level effectiveness for the *genetic health difference* and *race is genetic* vignettes show that while vignette acceptance is significantly associated with RBM population-level effectiveness for the *race is genetic* respondents (p < .001), there was no association between the two for respondents assigned to the *genetic health difference* vignette. Therefore, although the interaction term between the vignette acceptance scale and the vignette dummy variable was not statistically significant, indicating support for Hypothesis 5b, the lack of association between vignette acceptance and RBM behavioral orientation for the *genetic health difference* vignette respondents also indicates that vignette acceptance may in fact moderate the relationship between vignette type and the dependent variable.

Table 5.29: Multiple linear regression estimates, standard errors and R^2 for models examining vignette acceptance as moderator of *genetic health difference* versus *race is genetic* vignettes on RBM population-level effectiveness (n = 292).

	β	SE	β	SE
Intercept	1.425*	.619	.871	.650
***Genetic Health Difference* Vignette**	-.211	.152	.880	.690
Black	-.258	.223	-.288	.215
Sex	-.071	.150	-.096	.146
Education	.017	.052	.017	.050
Age	.004	.005	.004	.005
Vignette Acceptance	.245†	.130	.450**	.135
***Genetic Health Difference* * Vignette Acceptance**	--	--	-.372	.229
R^2 for model	.058		.073	

†$P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$.

5.3.2.9 Acceptance of Vignette's Effect on RBM Population-Level Effectiveness: Admixture Versus Race is Genetic Vignettes

Hypothesis 5c contends that there will be a significant difference between the *admixture* and *race is genetic* vignettes in the association between vignette acceptance and RBM population-level effectiveness. It proposes that greater acceptance of the *admixture* vignette will be associated with lower endorsement of RBM population-level effectiveness, while greater acceptance of the *race is genetic* vignette will be associated with higher endorsement of RBM population-level effectiveness. Table 5.30 presents the results of the multiple linear regression model testing vignette acceptance as a moderator of the association between vignette type and

RBM population-level effectiveness. The estimate for the interaction term between vignette acceptance and the *admixture* vignette dummy variable (with the *race is genetic* vignette condition as the referent category) indicates that vignette acceptance does moderate the relationship between vignette received and RBM population-level effectiveness (β = -.648, SE = .190, p = .001).

Table 5.30: Multiple linear regression estimates, standard errors and R^2 for models examining vignette acceptance as moderator of *admixture* versus *race is genetic* vignettes on RBM population-level effectiveness (n = 250).

	β	SE	β	SE
Intercept	2.107***	.593	1.160†	.630
***Admixture* Vignette**	-.195	.147	1.707**	.553
Black	-.406†	.243	-.421†	.226
Sex	.085	.147	.034	.139
Education	-.006	.051	-.001	.047
Age	.003	.005	.002	.005
Vignette Acceptance	.098	.113	.439**	.131
***Admixture* * Vignette Acceptance**	--	--	-.648**	.190
R^2 for model	.045		.097	

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Separate regression models were then conducted with the *admixture* vignette respondents and the *race is genetic* vignette respondents to assess their respective associations between the vignette acceptance scale and RBM population-level effectiveness. Table 5.28 presents the results of these models. The vignette-specific regression models indicate that vignette

acceptance was negatively associated with RBM behavioral orientation for respondents who received the *admixture* vignette (β = -.238, SE = .126, p = .062). Although it was not statistically significant at the .05-level, *admixture* vignette respondents who were more likely to accept the concept of admixture, as described in the vignette, were less likely to endorse RBM's potential effectiveness at reducing health disparities. Vignette acceptance was positively associated with RBM population-level effectiveness for respondents who received the *race is genetic* vignette (p < .001). Among the *race is genetic* respondents, those who were more likely to accept the idea that there is a genetic basis to race, as discussed in the vignette, were more likely to endorse RBM population-level effectiveness. The results indicate that vignette acceptance does moderate the relationship between type of vignette received and RBM population-level effectiveness for *admixture* versus *race is genetic* vignette types, thus, Hypothesis 5c for RBM population-level effectiveness is supported by the findings.

5.3.3 Summary of Results

Because of the substantial number of results presented in this chapter examining the *race vignette experiment's* effects on RBM-related beliefs and attitudes, Tables 5.31-5.34 respectively summarize the results for the following: the vignettes' effects on RBM beliefs and attitudes by vignette condition for total respondents, as well as by race, in each condition; racial differences in RBM beliefs and attitudes by vignette condition; the vignette acceptance scale's association with RBM beliefs and attitudes by vignette condition; and interaction effects between vignette acceptance and vignette condition on RBM beliefs and attitudes.

Table 5.31: Summary of statistically significant and non-significant findings for vignette condition's effect (compared to no-vignette control condition), and effect of overall *race vignette experiment,* on RBM individual-level effectiveness, behavioral orientation and population-level effectiveness, for total respondents and by race in each vignette condition (see Tables 5.5-5.7, 5.10-5.12, 5.15-5.17 for full results).

	***Race Is Genetic* v. Control**	***Social Construction* v. Control**	***Admixture* v. Control**	***Genetic Health Difference* v. Control**	**R^2_{Change} for *Race Vignette Experiment***
RBM Individual-Level Effectiveness					
Whites	NS [a]	NS	NS	NS	NS
Blacks	NS	NS	†	NS	
Total	NS	NS	NS	NS	
RBM Behavioral Orientation					
Whites	NS	NS	NS	NS	NS
Blacks	NS	NS	*	NS	
Total	NS	NS	NS	NS	
RBM Population-Level Effectiveness					
Whites	NS	NS	NS	NS	NS
Blacks	NS	NS	NS	NS	
Total	NS	NS	NS	NS	

[a] NS = Not Significant.

†$P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$.

Table 5.32: Summary of statistically significant and non-significant findings for white-black racial differences in RBM individual-level effectiveness, behavioral orientation and population-level effectiveness by *race vignette experiment* vignette condition (see Tables 5.4, 5.9 and 5.14 for full results).

	Race Is Genetic	***Social Construction***	***Admixture***	***Genetic Health Difference***	**No-Vignette Control**
RBM Individual-Level Effectiveness (Whites v. Blacks)	*	NS [a]	**	NS	NS
RBM Behavioral Orientation (Whites v. Blacks)	*	NS	*	NS	NS
RBM Population-Level Effectiveness (Whites v. Blacks)	NS	NS	*	†	NS

[a] NS = Not Significant.

†$P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$.

Table 5.33: Summary of statistically significant and non-significant findings for RBM individual-level effectiveness, behavioral orientation and population-level effectiveness regressed on the vignette acceptance scale, by vignette condition (see Tables 5.20, 5.24 and 5.28 for full results).

	Race Is Genetic	*Social Construction*	*Genetic Health Difference*	*Admixture*
RBM Individual-Level Effectiveness	***	NS [a]	NS	NS
RBM Behavioral Orientation	**	NS	NS	NS
RBM Population-Level Effectiveness	***	NS	NS	†

[a] NS = Not Significant.
†$P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$.

Table 5.34: Summary of statistically significant and non-significant findings for RBM individual-level effectiveness, behavioral orientation and population-level effectiveness regressed on interaction between the vignette acceptance scale and vignette condition (with the *race is genetic* vignette as referent category) (see Tables 5.19, 5.21-5.23, 5.25-5.27, 5.29-5.30 for full results).

	Vignette Acceptance * (*Race Is Genetic* v. *Social Construction)*	**Vignette Acceptance * (*Race Is Genetic* v. *Genetic Health Difference)***	**Vignette Acceptance * (*Race Is Genetic* v. *Admixture)***
RBM Individual-Level Effectiveness	**	†	***
RBM Behavioral Orientation	**	NS [a]	*
RBM Population-Level Effectiveness	**	NS	**

[a] NS = Not Significant.
†*P* < .10, **P* < .05, ***P* < .01, ****P* < .001.

5.4 Discussion

Because RBM has not been broadly integrated into the U.S. healthcare system, presumably, most participants in the vignette experiment had little to no familiarity with RBM. If this is the case, then it is possible that their beliefs about RBM's effectiveness and attitudes towards using RBM could be affected by information communicated to them about the relationship between race and genetics. I therefore examined whether or not the *race vignette experiment* had an effect on RBM-related beliefs and attitudes, and if it did, to what extent the experiment affected these beliefs and attitudes.

The results of the *race vignette experiment's* effect on RBM beliefs and attitudes were mixed. At first glance, it seems that the vignettes did not affect RBM beliefs and attitudes on the sample as a whole. According to the R^2_{Change} values, the addition of the vignette experiment to the multiple linear regression models for each RBM dependent variable indicated that the experiment as a whole did not have an effect on RBM beliefs and attitudes. The total sample means for RBM individual-level effectiveness, behavioral orientation and population-level effectiveness also did not substantially differ by vignette. The lack of difference between means by vignette condition was also the case for the white sub-sample, however for the black sub-sample, some of the vignette conditions were associated with substantially lower means for the RBM dependent variables compared to the other conditions in the *race vignette experiment.* This indicates that the vignettes may in fact have had differential effects on RBM beliefs and attitudes depending on the race of the respondent. Furthermore, the results from the vignette acceptance analyses showed that acceptance of the *race is genetic* vignette was strongly associated with RBM beliefs and attitudes, indicating that certain messages regarding the relationship between

race and genes can affect RBM beliefs and attitudes. The following is a discussion of the results of the *race vignette experiment's* effect on RBM beliefs and attitudes.

5.4.1 Race Vignette Experiment's Effects on RBM Beliefs and Attitudes

I hypothesized in Aim 4 that the vignette experiment would affect RBM-related beliefs and attitudes to the extent that respondents would vary in their endorsement of these constructs depending on the type of vignette they had received. Aim 4 results, however, indicated that overall the vignette experiment did not have a significant effect on RBM individual-level effectiveness, behavioral orientation or population-level effectiveness for the sample as a whole or by race. Because the experiment overall did not have statistically significant effects on the RBM dependent variables, genetic essentialist beliefs in racial differences was not tested as a mediator, and hypotheses predicting significant differences between individual vignette conditions were not tested.

The means by vignette condition for the total sample did not significantly vary for any of the three RBM dependent variables. Why this was the case warrants some attention, particularly because in a related study of the *race vignette experiment's* impact on beliefs in essential racial differences (Phelan, Link and Feldman, 2013; Phelan, Link, Johnson and Yang, under review), beliefs in essential racial differences did vary depending on the vignette condition to which study participants were assigned. This study by Phelan and colleagues showed that exposure to the *race is genetic, admixture* and *genetic health difference* vignettes resulted in greater beliefs in essential racial differences among white study participants when compared to those assigned to the *social construction* vignette or control condition. Among black participants, the baseline

level of essential racial differences beliefs was higher than that of the white participants, however, exposure to the vignette conditions resulted in approximately similar means for these beliefs when compared to the white participants. This indicates that the *race vignette experiment* had approximately the same effect on belief in essential racial differences regardless of whether the respondents were white or black. An analysis of a potential interaction effect between race and the vignettes found that there was no interaction effect for race among the vignette conditions, thereby verifying that the vignette experiment had similar effects on beliefs in essential racial differences for white and black study participants. The results of this related study by Phelan and colleagues suggest that the vignette experiment would have a similar effect on RBM-related beliefs and attitudes, since I initially proposed that conceptions regarding RBM's effectiveness are predicated on conceptions regarding the genetic or biological basis of racial categories, as indicated by Figure 5.1's causal pathway chart (p. 167). However, notably, the results in Chapter 4's analysis of baseline-level beliefs and attitudes regarding RBM showed that genetic essentialist beliefs was *not* significantly associated with RBM beliefs and attitudes. This finding may explain, in part, the reason why the *race vignette experiment* did not seem to have any overall effect on RBM-related beliefs and attitudes.

The results of the *race vignette experiment's* effect on RBM-related beliefs and attitudes instead indicate that lay conceptions regarding RBM's effectiveness and preferences for using RBM, may not necessarily be directly related to beliefs in a genetic basis to race. Perhaps some respondents interpreted RBM's effectiveness to be related to factors other than – or in addition to – genes, such as the environment or personal behaviors. It is also possible that because much of the public is unfamiliar with the concept of RBM, some of the respondents simply had not thought through the reasons for why something like RBM could be effective. As a result, their

conceptions of RBM may not have been influenced by exposure to mass media messages that are not directly related to the subject of RBM.

Another possible reason for the vignette experiment's lack of effect on respondents' RBM-related beliefs and attitudes is that they needed to be exposed to similar mass media messages on more than one occasion in order for the messages to have an effect on these conceptions (see Chong & Druckman, 2010 for more on differential effects of single versus multiple exposures to media messages over time on public opinion). The *race vignette experiment* only examined the effect of a single exposure to the vignette on RBM beliefs and attitudes. Content analyses of news stories about race and genes indicate that there have been a number of news stories in recent years with similar content to that used in this experiment. Therefore, it is plausible to infer that the public would be exposed to a particular message on more than one occasion, thereby possibly increasing the potential effect of such messages repeated over time on RBM beliefs and attitudes (Caulfield & Harry, 2008; Condit & Lynch, 2006; Phelan, Link & Feldman, 2013). It should be noted, however, that in Phelan and colleagues' (2013) related study of the *race vignette experiment's* effect on beliefs in essential racial differences, a single exposure to the assigned vignette was enough to result in significant differences in these beliefs depending on the vignette conditions to which respondents were assigned. It is possible that this effect after a single exposure may be due to the fact that the items used to measure essential racial differences belief were more familiar to respondents than those used to measure RBM beliefs and attitudes. Therefore, in order to better understand the extent to which varying messages about race and genes may affect RBM-related beliefs and attitudes, further research examining the effects of multiple exposures to a given message about race and genes on RBM beliefs and attitudes over time would be warranted.

Notably, the *race vignette experiment's* overall lack of influence on RBM-related beliefs and attitudes seemed to be driven by the white sub-sample. The means for the RBM-related dependent variables did not vary much by vignette condition for the white sub-sample. However, the findings showed that after exposure to either the *race is genetic* vignette or the *admixture* vignette, there were statistically significant differences between whites and blacks for the RBM-related dependent variables. Blacks were significantly less likely than whites to endorse RBM individual-level effectiveness, behavioral orientation and population-level effectiveness after being exposed to the *admixture* vignette and significantly less likely to endorse RBM individual-level effectiveness and behavioral orientation following exposure to the *race is genetic* vignette. Although the R^2_{Change} statistics had indicated that the *race vignette experiment* overall did not affect RBM-related beliefs and attitudes among the black sub-sample, the means for RBM individual-level effectiveness, behavioral orientation and population-level effectiveness were relatively lower for black respondents assigned to the *race is genetic* and *admixture* vignettes than those for black respondents assigned to the *social construction* vignette, *genetic health difference* vignette and control condition. The lack of statistically significant findings for the *race vignette experiment's* overall impact on black respondents' RBM beliefs and attitudes may be the result of small sample sizes for blacks who participated in the vignette experiment, which affected the statistical power of the analytical models (Cohen, 1977/1988).

It is unclear why the *race is genetic* message seemed to lower endorsement of RBM beliefs and attitudes for black respondents. If black respondents had on average rejected this vignette message, then lower endorsement of RBM beliefs and attitudes could be explained as a possible negative response to the vignette's message, with black respondents not endorsing RBM beliefs and attitudes as a means to reject the idea that there is a genetic basis to racial differences.

But, the mean for vignette acceptance among black respondents indicated that on average, blacks tended to accept this message. Multiple linear regression results also indicated that there were no significant differences in vignette acceptance rates for the various vignette conditions among black respondents, although it is possible that because of the small sample size for the black population in this study, the analyses were unable to detect differences that nonetheless exist.

Among black respondents, the *admixture* vignette was also associated with lower endorsement of RBM-related beliefs and attitudes. This is in contrast to Phelan et al.'s (under review) findings that the *admixture* vignette led to increased belief in essential racial differences. It seems that black respondents may have focused on the message that race is clinal and that most Americans are of mixed race, when evaluating the ideas of whether or not RBM could be effective and preferences for using RBM. This idea of believing that RBM could not be effective because most Americans are of mixed race is not necessarily inconsistent with also believing that there is a genetic basis to race (which is also suggested by the *admixture* vignette). This could explain why black respondents assigned to the *admixture* vignette condition simultaneously believed RBM is not effective but also had an increased belief in essential racial differences (as found in the Phelan et al. study) following exposure to the vignette.

The consequence of this finding that the *race is genetic* and *admixture* vignettes could lower black respondents' endorsement of the three RBM dependent variables is that how the relationship between race and genes is discussed in the news has the potential to affect RBM-specific beliefs and attitudes among the black population in the U.S. Notably, Phelan, Link and Feldman (2013) and Phelan, Link, Johnson and Yang (under review) respectively showed that the number of articles about race and genetics significantly increased over the period during and

following the completion of the Human Genome Project, and that a substantial portion of these articles were about direct-to-consumer ancestry tests/admixture testing. In addition to Phelan et al.'s (2013) finding that articles about race and genetics have been on the rise during the past two to three decades, there is also evidence to suggest that messages similar to the *race is genetic* vignette had specifically been on the rise during and following the completion of the Human Genome Project. Condit and Lynch's (2006) content analysis of articles about race and genes showed that there was a rise in articles that were slanted towards the position that there is a genetic basis to racial categories in the years during and following the completion of the Human Genome Project.

The increase in news stories presenting messages similar to those presented in the *race is genetic* and *admixture* vignettes suggests that the American public has been increasingly exposed to news stories that have the potential to decrease belief in RBM's effectiveness and preferences for using RBM among non-Hispanic black Americans specifically. If the intent behind developing and integrating RBM into the practice of medicine is to improve race-specific health inequalities (which is an argument that is meant to particularly resonate among racial and ethnic minorities who carry the burden of poorer health outcomes), then RBM supporters would need to take note that the black population in the U.S. may be less receptive towards using RBM depending on the extent to which they are exposed to mass media messages about race and genetics that are similar to those presented in the *race is genetic* and *admixture* vignettes.

The results examining the *race vignette experiment's* effects on RBM-related beliefs and attitudes indicate that single exposure to the assigned vignette condition had no effect for the white sub-sample regardless of the condition to which they were assigned, however, it did seem

to have some effect on RBM-related beliefs and attitudes for the black sub-sample, although not in expected directions. These findings suggest that while white and black Americans may not significantly differ in their beliefs about RBM's individual-level effectiveness or behavioral orientation (as indicated by the results in Chapter 4), mass media coverage of the relationship between race and genes may differentially affect these beliefs and attitudes depending on whether an individual identifies as white or black.

5.4.2 Vignette Acceptance as Moderator

Aim 5 hypothesized that acceptance or rejection of the messages communicated regarding the relationship between race and genes would have differential effects on RBM-related beliefs and attitudes depending on the vignette condition to which respondents were assigned. The results indicated support for Aim 5's hypotheses. Based on the findings, vignette acceptance is a moderator of type of vignette received and RBM beliefs and attitudes.

Notably, a significantly smaller proportion of respondents accepted the *race is genetic* vignette message in comparison to the other three vignette messages (57.9 percent for the *race is genetic* vignette, versus, 73.7 percent for the *admixture* vignette, 74.4 percent for the *genetic health difference* vignette and 81.3 percent for the *social construction* vignette). This suggests lower social acceptability of the *race is genetic* vignette's message and as such, can be characterized as the comparatively more controversial conception of race. The controversial nature of the *race is genetic* message may have influenced respondents assigned to this vignette to think more critically about their conceptions of race, consequently sensitizing respondents to also think more carefully about how they should respond to the RBM items.

Hypotheses 5a and 5c predicted that higher vignette acceptance would be associated with lower endorsement of RBM individual-level effectiveness, behavioral orientation and population-level effectiveness for respondents respectively randomized to the *social construction* and *admixture* vignettes, while higher vignette acceptance would be associated with higher endorsement of the three RBM dependent variables for those who were randomized to the *race is genetic* vignette. Because the *social construction* vignette specifically rejects the notion that there are genetic differences between racial groups, and the *admixture* vignette message can be interpreted to mean that most people – at least in the United States – are of mixed genetic heritages, the two hypotheses contended that greater acceptance of these vignette messages would lead to the belief that RBM should not be effective, since RBM implies that there are genetically distinct racial groups. Along these lines, hypotheses 5a and 5c predicted that greater acceptance of the *race is genetic* vignette message would be positively associated with the three RBM dependent variables because if there are distinct genetic differences between racial groups, then variations in treatment effectiveness depending on patients' racial heritages seem plausible.

However, while the results indicated that hypotheses 5a and 5c were correct in predicting that vignette acceptance is positively associated with the RBM dependent variables for respondents assigned to the *race is genetic* vignette, for respondents assigned to the *social construction* and *admixture* vignettes, vignette acceptance had no association with RBM beliefs and attitudes. Because the messages expressed in the latter two vignettes did not speak directly to the concept of RBM, it is possible that some respondents did not make a connection between these two messages and conceptions regarding RBM. Meanwhile, as previously noted, the controversial nature of the *race is genetic* message could have prompted respondents assigned to this vignette to be more aware of the vignette's message and its potential connection to RBM.

The controversy surrounding the *race is genetic* message could explain why there was a strong association between vignette acceptance and the RBM dependent variables only for respondents exposed to the *race is genetic* vignette and not the *social construction* or *admixture* vignettes.

While the findings indicated that vignette acceptance moderated the association between the vignette experiment and RBM beliefs and attitudes, only acceptance or rejection of the more controversial *race is genetic* vignette message influenced the RBM dependent variables, whereas acceptance or rejection of the less controversial *social construction* and *admixture* vignette messages seemed to have no systematic influence on RBM beliefs and attitudes. Although different types of messages regarding the relationship between race and genetics have been presented in the mass media over the years, a previous mass media study of race and genetics news stories has shown that while both the position that race is genetic and that race is socially constructed can be found in the news media, presentations of this subject have tended to be slanted in the direction that there is a genetic basis to race (Condit & Lynch, 2006). Because this particular conception of race and genes has been dominant in the more recent news media, and, this vignette experiment indicated that more than half of the *race is genetic* vignette respondents accepted the vignette's message as accurate, it is possible that increasing coverage of articles discussing the relationship between race and genes has led to increasing beliefs that RBM is effective among those who have followed mass media's coverage of news about race and genetics generally, as well as RBM-related news specifically.

Hypothesis 5b predicted that there would be no difference in the association between vignette acceptance and RBM beliefs and attitudes for respondents assigned to the *genetic health difference* and *race is genetic* vignettes. The rationale behind this hypothesis is that the *genetic*

health difference vignette implies, albeit indirectly, that there is some genetic basis to racial difference (in this case a health-related difference) and therefore, just like as was predicted for the *race is genetic* vignette, greater acceptance of this vignette would be associated with greater endorsement of RBM beliefs and attitudes. Statistically, the results indicated support for this hypothesis – the interaction terms in the multiple linear regression models showed that there was no significant difference between the *race is genetic* and *genetic health difference* vignettes in the association between vignette acceptance and RBM-related beliefs and attitudes. However, vignette acceptance was not significantly associated with any of the three RBM dependent variables among the *genetic health difference* vignette respondents, whereas they were significantly associated with all three RBM dependent variables for the respondents assigned to the *race is genetic* vignette. Therefore, despite the lack of significant difference between these two vignettes, unlike the *race is genetic* vignette, the results for the *genetic health difference* vignette indicate that there was no clear evidence to suggest that mass media coverage of race-specific genetic health differences would be associated with greater endorsement of RBM's effectiveness at the individual and population levels and preferences for using RBM.

Prior research on mass media's effects on public opinion has shown that the public is more likely to accept messages that are consistent with their own beliefs and reject messages that are inconsistent. McQuail (1979) in his study of mass media effects on public opinion contends that media campaigns that are the most successful tend to be those that either reinforce existing beliefs and attitudes or only slightly redirect these beliefs and attitudes. Highly slanted messages that do not reinforce one's beliefs and attitudes, therefore, are less likely to produce change. Zaller (1992) notes that with respect to political campaigns, the public tends to resist arguments that are inconsistent with their own political predispositions. Although the extent to which

conceptions of race are political may vary depending on the context, race-related policies and the attitudes and beliefs that result in support or opposition to these policies are most certainly political. Thus, it is possible that just like mass media effects on lay political opinions, much of the public would resist mass media messages about race that are inconsistent with their own conceptions of race. This may partially explain why rejection of the controversial position that there is a genetic basis to race was strongly associated with RBM-related beliefs and attitudes, but this was not the case for respondents assigned to the *social construction*, *admixture* or even *genetic health difference* vignettes.

In sum, the vignette experiment's effect on RBM-related beliefs and attitudes seemed to vary depending on the race of the respondents. The vignette experiment had no effect on white respondents' RBM-related beliefs and attitudes, but there was some evidence to suggest differences in the vignettes' effects on RBM-related beliefs and attitudes among the black respondents, albeit in an unexpected direction. These findings differ from those found by Phelan and colleagues regarding the vignette experiment's effects on essential racial differences beliefs. While in Phelan et al.'s study single exposure to mass media messages about race and genetics seemed to increase or decrease belief in essential racial differences depending on the type of message that was presented, a single exposure to such messages did not, in turn, influence beliefs about RBM in this dissertation study for the white sub-sample, which suggests that belief in essential racial differences may not be associated with RBM beliefs and attitudes among the white sub-sample, at least not after a single exposure to a message about race and genes.

RBM-related beliefs and attitudes among the black sub-sample, on the other hand, seemed to be influenced by the *race is genetic* and *admixture* vignettes specifically, albeit in

unexpected directions. For both vignettes, these messages seemed to lower belief in RBM's effectiveness and preferences for using RBM, which is in opposition to the vignettes' effects of increasing belief in essential racial differences for the same sample in Phelan and colleagues' studies (2013, under review). This finding also suggests that there may not be a positive association between belief in essential racial differences and RBM-related beliefs and attitudes for black Americans, indicating that factors other than beliefs about the relationship between race and genes influence black Americans' beliefs regarding RBM's effectiveness and preferences for using RBM. Why there would be a discrepancy between whites and blacks for mass media's effects on RBM beliefs and attitudes is an area that warrants further research, as mass media is a major source of information on new science and biomedical research findings and their applications for the lay public (Condit, 2007; Condit & Bates, 2005; Condit, Parrott & Harris, 2002; Conrad, 1997; Loo et al., 1998; National Health Council, 1997; Moynihan et al., 2000; Nelkin & Lindee, 1995; Sitthi-amorn & Ngamvithayapongse, 1998).

Chapter 6:

PART 3: PERSONALIZED GENOMIC MEDICINE BELIEFS AND ATTITUDES

6.1 Introduction

The findings from Chapter 4's analysis of RBM beliefs and attitudes showed that whites, blacks and Hispanics did not significantly differ in their beliefs regarding the effectiveness of RBM and attitudes towards using RBM, with the exception of belief in RBM's ability to address health inequalities. Chapter 5 expanded on this finding of relatively few racial differences in RBM-related beliefs and attitudes by examining the extent to which a vignette experiment involving mock news articles about different relationships between race and genes had an effect on RBM-related beliefs and attitudes and whether there were racial differences in this effect. The findings showed that while the vignette experiment did not have an overall effect on RBM beliefs and attitudes among the white sub-sample, it did seem to have an effect on the black sub-sample, as evidenced by lower mean endorsement levels for RBM beliefs and attitudes among black respondents exposed to the *race is genetic* and *admixture* vignettes compared to the other vignette conditions. This suggests possible racial differences in RBM-related beliefs and attitudes in the future if the American public becomes more familiar with RBM and continues to be exposed to mass media messages about the relationship between race and genes. This chapter expands this body of new research regarding RBM-related beliefs and attitudes by examining the extent to which white and black Americans hold similar or different views regarding the effectiveness of, as well as preferences for using, personalized genomic medicine (PGM). This

chapter will also present findings from analyses comparing white and black respondents' beliefs and attitudes regarding PGM with their beliefs and attitudes regarding RBM.

A better understanding of Americans' beliefs and attitudes regarding PGM provides an important context by which RBM beliefs and attitudes can be evaluated. We would expect for there to be differences between the two, with Americans supporting PGM at greater levels because it is tailored to the genomic profiles of individuals rather than to the (controversial and contested) genomic profiles of racial or ethnic populations. However, it is possible that Americans would endorse the effectiveness of and preferences for using RBM and PGM at equal levels. Perhaps Americans in general are equally wary of, or enthusiastic about, any new and less familiar form of health technology, whether it is a medication that is allegedly more effective in a specific racial or ethnic group, or a medication that is based on new genomic research findings. This final results chapter therefore seeks to better understand Americans' beliefs and attitudes regarding RBM by comparing them with those related to PGM.

There have been several studies that have examined lay conceptions regarding PGM. Bevan et al. (2003) in their study of lay beliefs regarding RBM, PGM or the usual course of treatment found that when given the choice, 75 percent of study participants preferred to use treatments based on individualized genetic testing (i.e., PGM), while 9 percent said they would prefer the usual course of treatment. Only 4 percent said they would prefer to use RBM. In a more recent vignette experiment study, Butrick and colleagues (2011) similarly found that respondents were more likely to support use of conventional treatments (i.e., the usual course of treatment) than RBM. However, although respondents viewed conventional treatment and PGM equally favorably, black and other racial and ethnic minority participants in this study were more

reluctant than whites to indicate a preference to use PGM compared to conventional treatment. The primary reason cited for this reluctance was lack of trust in their physicians.

Haddy et al.'s (2010) focus group study of members of the public who had a chronic medical condition and/or had family members with a chronic medical condition were asked about their views on the implementation of PGM. Overall, participants believed that PGM had the potential to improve treatments, but they were concerned about issues of storage and privacy of genetic information, as well as the costs involved with PGM. Rogausch and colleagues' (2006) study of attitudes towards pharmacogenetic testing among German asthma and chronic pulmonary disease patients found that 96 percent of study participants appreciated the availability of pharmacogenetic testing for diseases like asthma, but 35 percent were fearful of potential adverse results, and 36 percent were concerned about privacy issues surrounding the results. They also found social differences in attitudes – females were more likely to have fearful attitudes towards pharmacogenetic testing than males, while younger participants were more likely to be hopeful about the usefulness of pharmacogenetic testing. Meanwhile, Almarsdóttir and colleagues (2005) found that focus group participants in their study on PGM attitudes were generally concerned about the ethical implications of pharmacogenomic drug development and use, mostly with respect to equitable access to these drugs and implications for local and global health inequalities.

The literature indicates that there are various social differences in beliefs and attitudes regarding PGM. Although the literature is relatively thin regarding potential racial differences in PGM-specific beliefs and attitudes, there have been several studies that have examined racial and ethnic differences in genetic testing attitudes more generally or specific to certain diseases. One

study that examined whites' and African Americans' attitudes towards Alzheimer's disease genetic testing found that African Americans overall were less interested in getting tested, endorsed fewer reasons for pursuing genetic testing and anticipated fewer negative consequences from a negative test result, although this difference may be due more to lower knowledge levels and awareness of Alzheimer's disease among African Americans compared to whites (Hipps et al., 2003). Another study that examined white, black and Latina women's attitudes towards genetic testing for various types of cancers found that Latina and black women were more concerned than white women about genetic testing abuses, and Latina women were more likely than white and black women to agree with statements asserting the disadvantages of genetic testing (Thompson et al., 2003). Sussner, Thompson, Valdimarsdottir, Redd and Jandorf's (2008) study examining the relationship between acculturation and attitudes towards genetic testing found that among Latinos and Latinas in the U.S., higher levels of acculturation were associated with greater familiarity with genetic testing, greater perceived benefits and lower likelihood to cite perceived barriers.

Prior studies examining racial differences in genetic testing attitudes generally, as well as several that have examined racial differences in PGM beliefs and attitudes more specifically, indicate that blacks and other racial and ethnic minority populations would be less likely to prefer to use PGM than whites, and potentially less likely to endorse PGM's effectiveness. Other studies, however, have suggested that blacks and other racial/ethnic minority groups have at times been found to hold favorable beliefs and attitudes with respect to the safety and clinical effectiveness of PGM specifically, and other genetic biomedical applications more generally, finding little differences in attitudes towards PGM and genetic testing between differing racial and ethnic groups (Butrick et al., 2011; Marco, 2010). One study that examined the extent to

which there are regional differences associated with genetic testing attitudes found that attitudes towards genetic disease testing and ancestry testing were largely due to geographic differences, and these differences were not more strongly associated with race/ethnicity, sex, age, educational attainment, religion or previous experience with genetic testing/counseling (Jonaissaint et al., 2010).

Because to date there has not been a nationally representative study examining beliefs and attitudes regarding PGM, as the first nationally representative study of these beliefs and attitudes, the following presents important insight into whether racial differences do exist regarding PGM-related beliefs and attitudes as well as how they compare with those regarding RBM. The following describes the aims that are examined in this chapter:

Aim 6. Aim 6 examines whether there are racial differences in PGM individual-level effectiveness and behavioral orientation beliefs and attitudes. Past research has shown some racial differences in genetic technology-related beliefs and attitudes. Differences in genetic testing rates among different racial and ethnic groups have been reported (Singer, Antonucci & Van Hoewyk, 2004). Because PGM requires genetic testing in order for treatment to be personalized to one's genetic profile, if there currently are racial and ethnic differences in utilization of genetic technology, it is possible that there are racial and ethnic differences in beliefs about PGM's effectiveness. According to Singer and colleagues (2004), although whites were more likely to express an interest in using genetic testing, blacks were more likely to express specific preferences for using prenatal and adult genetic testing than whites. However, blacks may also hold other beliefs and attitudes that conflict with or over-ride these attitudes in specific situations, such as concerns about cost, discrimination or general mistrust towards

medical authority (Hipps et al., 2003; Robert, 2011; Thompson et al., 2003). Despite the mixed findings from prior studies regarding racial differences in PGM-specific and related beliefs and attitudes, because it has been shown that concerns like cost, discrimination and medical mistrust are held by blacks regarding health care and health-related technologies more broadly, it seems logical to predict that blacks would be less likely to endorse the effectiveness of PGM and less likely to prefer using PGM than whites.

> ***Hypothesis 6:*** Whites will be more likely than blacks to endorse the individual-level effectiveness of PGM and prefer to use PGM.

Aim 7. Aim 7 compares PGM individual-level effectiveness belief and behavioral orientation with RBM individual-level effectiveness belief and behavioral orientation. Much of the support among researchers and clinicians for RBM has been grounded in the belief that it is an acceptable interim alternative until a system based on PGM can be realized (Burchard et al., 2003; Risch et al., 2002). There is currently very little data that examines public beliefs about PGM on its own and in comparison to RBM. Because some in the biomedical industry support the idea of RBM as an interim alternative for PGM, it seems reasonable to examine the extent to which the public varies in its degree of support for these two forms of medicine. Two studies that examined beliefs and attitudes regarding both RBM and PGM found that respondents overwhelmingly preferred PGM in comparison to RBM (Bevan et al., 2003; Butrick et al., 2011). I therefore expected to find that respondents in this dissertation study also endorsed PGM beliefs and attitudes to a greater degree than RBM beliefs and attitudes.

Hypothesis 7: PGM individual-level effectiveness and behavioral orientation endorsement levels will be greater than those for RBM individual-level effectiveness and behavioral orientation.

6.2 Research Design and Methods

6.2.1 Sample

The sample used to analyze Aims 6 and 7 was the same as that used to examine Aims 4 and 5 in Chapter 5. Once again, this sample was comprised of 632 non-Hispanic white and non-Hispanic black adults aged 18 or older who were assigned to the *race vignette experiment* (see pp. 168-170 in Chapter 5 to review the details regarding this sample).

6.2.2 Measures

The primary independent variable for these analyses is race. The two racial categories are white and black. A dummy variable was created with white as the referent category. All multiple regression analyses for Aim 6 were adjusted to control for possible confounding by the following socio-demographic variables: sex (male = 1, female = 0), age, educational attainment and geographic origin (see p. 81 and p. 94 in Chapter 3 for an in-depth description of the independent variable and covariates). Because the respondents were also exposed to vignettes that discussed genetics - albeit in the context of race and not PGM - the multiple linear regression analyses were also adjusted for vignette received (*race is genetic, social construction, admixture* and *genetic health differences*) to control for possible confounding as a result of vignette exposure (see p. 81 in Chapter 3 for an in-depth description of the *race vignette experiment* dummy variables). The dependent variables used for Aim 6 analyses were PGM individual-level

effectiveness and PGM behavioral orientation. Aim 7 analyses also included RBM individual-level effectiveness and RBM behavioral orientation as dependent variables, as well as the RBM-PGM individual-level effectiveness difference score and RBM-PGM behavioral orientation difference score (see pp. 82-89 in Chapter 3 for an in-depth description of the dependent variables used for these analyses).

6.2.3 Analyses

Analysis of Aim 6. For aim 6, I assessed whether there are racial differences in beliefs about PGM individual-level effectiveness and behavioral orientation. Frequencies and means were calculated and multiple linear regression was used to examine whether there are racial differences in PGM individual-level effectiveness and behavioral orientation beliefs and attitudes (see Table 6.1, Model 35). The multiple linear regression model was adjusted to control for socio-demographic variables (sex, education, age and geographic region) and the vignette experiment dummy variables in order to reduce the effect of potential confounding on the dependent variables. Although the vignettes used in the *race vignette experiment* focused on the relationship between race and genes and did not discuss PGM, it is possible that some of the vignettes could have residual effects on PGM-related beliefs and attitudes. Therefore, all of the multiple linear regression analyses that involved the PGM dependent variables were adjusted to control for the *race vignette experiment.*

Interaction terms were then created between race and each socio-demographic control variable other than geographic region. One reason for why potential interaction effects were examined between race and various socio-demographic variables is because prior research has shown associations between PGM-related beliefs and attitudes and certain socio-demographic

variables such as age and sex (Rogausch et al., 2006). It is possible that these two variables would be differentially associated with PGM beliefs and attitudes depending on the race or ethnicity of individuals. Additionally, I wanted to examine whether socioeconomic status (as measured by education) would have a differential level of association with the PGM dependent variables for white versus black respondents. It is possible that PGM endorsement among blacks may vary differently compared to whites depending on their educational backgrounds. These interaction terms were entered into multiple linear regression models for PGM individual-level effectiveness and behavioral orientation in order to assess whether whites and blacks differ in terms of the relationships between sex, education and age and both dependent variables (see Table 6.1, Model 37). Model 37 was also adjusted to control for vignette experiment condition. Separate analyses were then conducted for the white and black sub-samples, this time examining the socio-demographic control variables as independent variables (see Table 6.1, Models 38 and 39).

Table 6.1: Variables used in Aim 6 multiple linear regression models.

Variable Type	Model 36	Model 37	Model 38 (Whites only)	Model 39 (Blacks only)	Model 41	Model 42
Dependent Variables	PGM individual-level effectiveness and behavioral orientation	PGM individual-level effectiveness and behavioral orientation	PGM individual-level effectiveness and behavioral orientation	PGM individual-level effectiveness and behavioral orientation	RBM-PGM individual-level effectiveness and behavioral orientation difference scores	RBM-PGM individual-level effectiveness and behavioral orientation difference scores
Independent Variables	Race	Race	Socio-demographic variables[b]	Socio-demographic variables[b]	Race	Race
Covariates	Socio-demographic variables[a] and vignette experiment variables	Socio-demographic variables[a] and vignette experiment variables	Vignette experiment variables and geographic region	Vignette experiment variables and geographic region	Socio-demographic variables[b] and vignette experiment variables	Socio-demographic variables[b] and vignette experiment variables
Interaction Terms	--	Race*Socio-demographic variables[a]	--	--	--	Race*vignette experiment variables

[a] The socio-demographic variables are sex (male =1, female = 0), education, age and geographic region.
[b] The socio-demographic variables are sex (male =1, female = 0), education, and age.

Analysis of Aim 7. The purpose of this aim is to compare PGM individual-level effectiveness and behavioral orientation beliefs and attitudes with its RBM-related counterparts. For this aim, I compared means and frequencies for PGM individual-level effectiveness and behavioral orientation scores with those for RBM individual-level effectiveness and behavioral orientation scores. These analyses were stratified by *race vignette experiment* condition as well as race. A crosstabulation analysis among the respondents was also conducted between PGM and RBM individual-level effectiveness as well as PGM and RBM behavioral orientation, stratified by vignette condition and race, in order to evaluate concordance in beliefs and attitudes between the two respective sets of measures.

Student's *t*-tests were conducted to assess whether the mean RBM-PGM individual-level effectiveness and behavioral orientation difference scores significantly differed from zero (Model 40). Student's *t*-tests on the RBM-PGM difference scores allows for us to see if on average, the magnitude of difference between individual respondents' RBM and PGM scores were significantly different from zero. Student's *t*-tests were conducted on the RBM-PGM difference scores in lieu of paired *t*-tests between the respective RBM and PGM variables because the SPSS Complex Samples module, which was used for all analyses in this dissertation study, does not allow for paired *t*-test analyses. Due to the complex sampling design of the survey, the basic SPSS software package could not be used on the study's data set. The Student's *t*-tests were separately conducted for each *race vignette experiment* condition in an effort to adjust for the potential effects of the vignettes on RBM- and PGM-related beliefs and attitudes. In addition, *t*-tests were separately conducted by race in order to assess potential differences between white and black respondents for the RBM-PGM difference scores by vignette condition.

Both the RBM-PGM individual-level effectiveness and RBM-PGM behavioral orientation difference scores were then regressed on race, adjusting for socio-demographic variables and the *race vignette experiment,* in order to evaluate whether whites and blacks significantly differed overall in their difference scores (see Table 6.1, Model 41). If whites and blacks significantly differed in this analysis, then that would show that the amount of difference between endorsement levels of RBM and PGM beliefs and attitudes was substantially different between white and black Americans despite any potential effects of the vignette experiment on endorsement of these two constructs.

In order to assess whether the *race vignette experiment* had differential effects on whites and blacks in the magnitude, and possibly, direction of respondents' difference scores, RBM-PGM individual-level effectiveness and behavioral orientation difference scores were also separately regressed on race by *race vignette* interaction terms, adjusting for socio-demographic variables (see Table 6.1, Model 42). If the results of this analysis examining potential interaction effects between race and the *race vignette experiment* on the difference between respondents' RBM and PGM scores were significant, then that would indicate that whites and blacks differ in the effect of mass media exposure to messages about race and genes on both RBM and PGM beliefs and attitudes.

6.3 Results

6.3.1 Aim 6: Beliefs and Attitudes towards Personalized Genomic Medicine

6.3.1.1 Personalized Genomic Medicine Individual-Level Effectiveness

Table 6.2 presents the frequencies, means and standard errors for PGM individual-level effectiveness for the sample as a whole as well as by race. The frequencies show that approximately twenty percent more of the white sub-sample in comparison to the black sub-sample endorsed the belief that PGM would be effective at the individual level (76.9 percent of whites versus 57.0 percent of blacks). The mean PGM individual-level effectiveness scores were 3.00 (SE = .035) for the white sub-sample and 2.70 (SE = .122) for the black sub-sample, based on a range of 1 to 4.

Table 6.2: Frequencies, means and standard errors for PGM individual-level effectiveness belief for total sample and by race: United States, 2009.

Dependent variables	Total, %	Whites, %	Blacks, %
Personalized genomic medicine is effective at individual level	(n = 632)	(n = 553)	(n = 79)
Agree	74.4	76.9	57.0
Neither agree nor disagree	11.1	10.3	17.7
Disagree	14.5	12.8	25.3
Mean (SE)	2.96 (.034)	3.00 (.035)	2.70 (.122)

Table 6.3 presents the multiple linear regression models that examined whether or not there are racial differences in PGM individual-level effectiveness belief. Model 36 in Table 6.3 shows that after controlling for sex, education, age, geographical region and the *race vignette experiment*, black respondents were significantly less likely than white respondents to endorse PGM individual-level effectiveness ($p < .05$). Notably, Model 36 also showed that education was positively associated with PGM individual-level effectiveness, indicating that the greater the education level of respondents, the more likely they were to endorse PGM's effectiveness at the individual level.

Table 6.3: PGM individual-level effectiveness regressed on race and race by socio-demographic variables interaction terms, adjusting for vignette received, for total sample (n = 628).

	Model 36		Model 37	
	β	**SE**	**β**	**SE**
Intercept	2.496***	.240	2.609***	.245
Black	-.273*	.109	-1.602†	.822
Male	.030	.067	.022	.069
Education	.052*	.021	.043†	.022
Age	.003	.002	.003	.002
***Admixture* Vignette**	-.317**	.104	-.318**	.104
***Social Construction* Vignette**	.190*	.093	-.200*	.095
***Race Is Genetic* Vignette**	-.206*	.093	-.205*	.094

Table 6.3: PGM individual-level effectiveness regressed on race and race by socio-demographic variables interaction terms, adjusting for vignette received, for total sample (n = 628).

	Model 36		Model 37	
	β	**SE**	**β**	**SE**
***Genetic Health Difference* Vignette**	-.121	.114	-.122	.114
Northeast	-.109	.135	-.115	.136
Midwest	.004	.091	.001	.092
South	-.016	.109	-.016	.107
Rocky Mountain/Southwest	-.013	.125	-.024	.126
West	-.088	.106	-.089	.107
Black * Male	--	--	.099	.197
Black * Education	--	--	.130†	.068
Black * Age	--	--	.000	.005

Note. All reported results are weighted. SE = standard error.
$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Table 6.3's Model 37 shows the estimates and standard errors for the model that tests possible interaction effects between race and several socio-demographic variables (sex, education and age) for PGM individual-level effectiveness. Model 37 results indicate one possible interaction effect between race and education, although this was not significant at the .05-level. The separate multiple linear regression models for the white and black sub-samples (respectively Model 38 and Model 39 in Table 6.4) show that while education may be positively

associated with PGM individual-level effectiveness for the white sub-sample, this association was not statistically significant at the .05-level. There was, however, a statistically significant positive association between education and PGM individual-level effectiveness for the black sub-sample ($p < .05$). This indicates that the greater the level of educational attainment for the black sub-sample, the more likely they were to endorse the belief that PGM would be effective at the individual level.

Notably, black respondents exposed to the *race is genetic* vignette and *admixture* vignette were significantly less likely than black respondents in the control condition to endorse the belief that PGM is effective at the individual level ($p < .01$). White respondents assigned to the *admixture* vignette were also less likely than white control group respondents to endorse PGM individual-level effectiveness belief, however, the *race is genetic* vignette did not seem to have an effect on PGM individual-level effectiveness belief for the white respondents exposed to that vignette. The results for the descriptive statistical and multiple linear regression analyses collectively indicate support for Hypothesis 6, which predicted that whites would be more likely than blacks to endorse the individual-level effectiveness of PGM.

Table 6.4: PGM individual-level effectiveness regressed on socio-demographic variables, adjusting for vignette received, by race.

	Model 38 White (n = 549)		Model 39 Black (n = 79)	
	β	**SE**	**β**	**SE**
Intercept	2.557***	.244	1.805**	.621
Male	.020	.069	.431*	.180
Education	.043†	.022	.130*	.049
Age	.003	.002	-.002	.005
***Admixture* Vignette**	-.227*	.096	-1.066**	.308
***Social Construction* Vignette**	-.178†	.095	-.333	.292
***Race Is Genetic* Vignette**	-.124	.098	-.956***	.256
***Genetic Health Difference* Vignette**	-.104	.122	-.124	.249
Northeast	-.093	.144	-.242	.268
Midwest	.002	.100	.058	.206
South	.037	.107	-.228	.216
Rocky Mountain/Southwest	-.039	.130	.831†	.488
West	-.114	.111	.302	.309

Note. All reported results are weighted. SE = standard error.
†*P* < .10, **P* < .05, ***P* < .01, ****P* < .001.

6.3.1.2 Personalized Genomic Medicine Behavioral Orientation

Table 6.5 presents frequencies, means and standard errors for PGM behavioral orientation. The results show that 92.7 percent of the white sub-sample either somewhat or strongly agreed with the attitude that they would prefer to use PGM, while 75.9 percent of the black sub-sample somewhat or strongly agreed with this attitude. The mean score for PGM behavioral orientation for whites was 3.43 (SE = .045), while for blacks it was substantially lower at 3.03 (SE = .165).

Table 6.5: Frequencies, means and standard errors for PGM behavioral orientation for total sample and by race: United States, 2009.

Dependent variables	Total, %	Whites, %	Blacks, %
Prefer to use personalized genomic medicine	(n = 629)	(n = 550)	(n = 79)
Somewhat/Strongly Agree	90.6	92.7	75.9
Somewhat/Strongly Disagree	9.4	7.3	24.1
Mean (SE)	3.38 (.046)	3.43 (.045)	3.03 (.165)

Model 36 in Table 6.6 shows that black respondents were, in fact, significantly less likely than white respondents to prefer to use PGM ($p < .05$). Model 37 in Table 6.6 presents the results of the full multiple linear regression model for PGM behavioral orientation that includes the interaction terms for race by the socio-demographic variables. The results from this model indicate an interaction effect between race and education for RBM behavioral orientation ($p <$

.05). Models 38 and 39 in Table 6.7 present the results for PGM behavioral orientation regressed on the socio-demographic variables for the white and black sub-samples respectively. The results show that while there was no association between education and PGM behavioral orientation for the white sub-sample, there was a significant positive association between the two variables for the black sub-sample indicating, once again, that as educational level attainment increased, preferences for using PGM also increased for the black sub-sample but not the white sub-sample.

Table 6.6: PGM behavioral orientation regressed on race and race by socio-demographic variables interaction terms, adjusting for vignette received, for total sample (n = 625).

	Model 36		**Model 37**	
	β	**SE**	**β**	**SE**
Intercept	3.369***	.310	3.576***	.327
Black	-.380*	.150	-2.724**	.024
Male	.044	.090	.038	.091
Education	.013	.025	-.003	.027
Age	.004	.003	.004	.003
***Admixture* Vignette**	-.304*	.122	-.304*	.118
***Social Construction* Vignette**	-.197†	.107	-.223*	.106
***Race Is Genetic* Vignette**	-.355**	.116	-.350**	.110
***Genetic Health Difference* Vignette**	-.160	.142	-.167	.139

Table 6.6: PGM behavioral orientation regressed on race and race by socio-demographic variables interaction terms, adjusting for vignette received, for total sample (n = 625).

	Model 36		Model 37	
	β	**SE**	**β**	**SE**
Northeast	-.092	.157	-.097	.157
Midwest	-.015	.100	-.013	.100
South	-.070	.129	-.068	.125
Rocky Mountain/Southwest	-.008	.130	-.027	.129
West	-.361*	.164	-.355*	.166
Black * Male	--	--	.083	.284
Black * Education	--	--	.215*	.089
Black * Age	--	--	.004	.006

Note. All reported results are weighted. SE = standard error.
$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Table 6.7: Personalized genomic medicine behavioral orientation regressed on socio-demographic variables, adjusting for vignette received, by race.

	Model 38 White (n = 546)		Model 39 Black (n = 79)	
	β	**SE**	**β**	**SE**
Intercept	3.500***	.320	1.928*	.725
Male	.035	.090	.674*	.261
Education	-.002	.026	.152*	.063
Age	.004	.003	-.002	.007
***Admixture* Vignette**	-.212†	.110	-1.095*	.409
***Social Construction* Vignette**	-.226*	.112	-.144	.288
***Race Is Genetic* Vignette**	-.244*	.120	-1.318***	.280
***Genetic Health Difference* Vignette**	-.152	.152	-.056	.329
Northeast	-.053	.164	-.368	.369
Midwest	.032	.104	-.176	.305
South	-.023	.117	-.195	.383
Rocky Mountain/Southwest	-.016	.134	.482	.822
West	-.404*	.176	.279	.331

Note. All reported results are weighted. SE = standard error.
$^{\dagger}P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$.

It is notable, once again, that black respondents exposed to the *race is genetic* ($p < .001$) or *admixture* ($p < .05$) vignettes were significantly less likely than black respondents in the control condition to prefer to use PGM. White respondents assigned to the *admixture* vignette

also seem to be less likely than white control group respondents to prefer to use PGM, however, this was not significant at the .05-level. Geographic region in which the respondents reside did not seem to be associated with PGM behavioral orientation, with the exception of white respondents residing in the West coast. White respondents from the West coast were significantly less likely than white respondents from the Southeast to prefer to use PGM.

Once again, the results for the descriptive statistical and multiple linear regression analyses indicate support for Hypothesis 6, which predicted that a greater portion of white respondents would prefer to use PGM compared to black respondents.

6.3.2 Aim 7: Comparison of Personalized Genomic Medicine Beliefs and Attitudes with Race-Based Medicine Beliefs and Attitudes

6.3.2.1 PGM versus RBM Individual-Level Effectiveness

In order to compare endorsement levels between PGM individual-level effectiveness and RBM individual-level effectiveness, Tables 6.8-6.12 present the means and standard errors for the two constructs by *race vignette* condition as well as by race. Figures 6.1-6.5 chart the means for the total sample and the white and black sub-samples for each of their respective tables. The results indicate that PGM individual-level effectiveness sample means were somewhat to substantially higher than those for RBM individual-level effectiveness for each of the vignette conditions. This was case for the total sample in each experimental condition as well as for the white and black sub-samples.

Table 6.8: Means and standard errors for RBM individual-level effectiveness and PGM individual-level effectiveness beliefs among the *race vignette experiment* control group.

	RBM Individual-Level Effectiveness			PGM Individual-Level Effectiveness		
	n	**$\bar{X}$**	**SE**	**n**	**$\bar{X}$**	**SE**
Total	84	2.54	.078	85	3.15	.067
Whites	73	2.55	.088	74	3.15	.074
Blacks	11	2.50	.168	11	3.16	.125

Figure 6.1: Means for total *race vignette experiment* control group and by race for RBM individual-level effectiveness and PGM individual-level effectiveness.

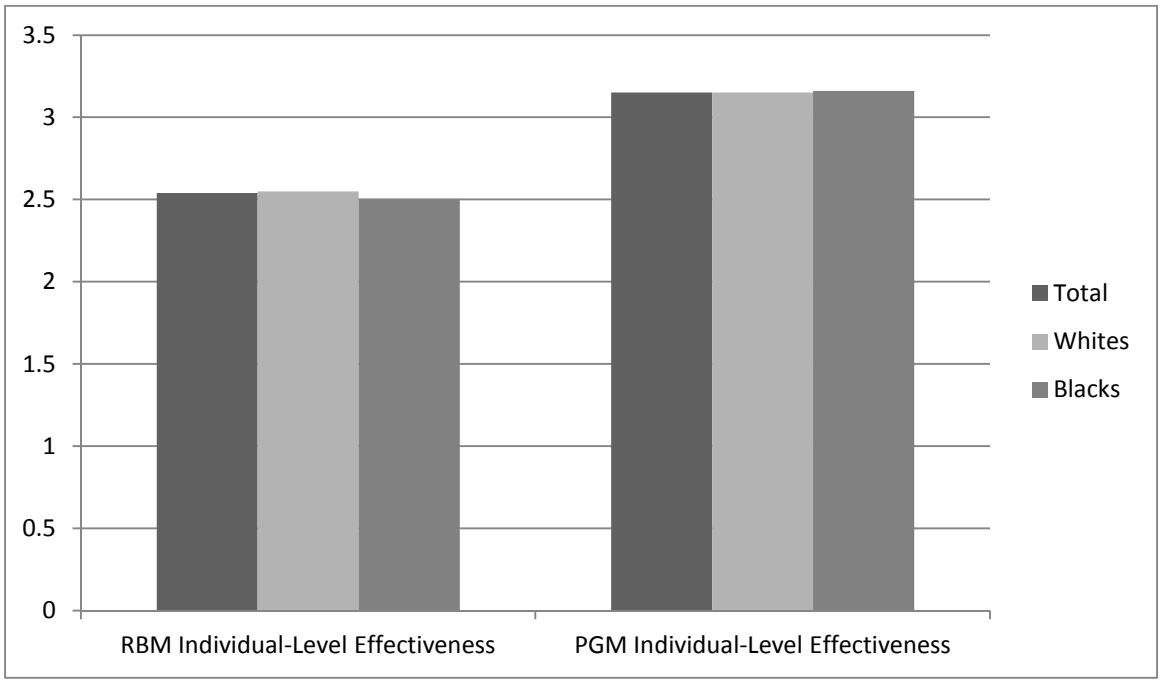


Table 6.9: Means and standard errors for RBM individual-level effectiveness and PGM individual-level effectiveness beliefs among the *social construction* vignette condition.

	RBM Individual-Level Effectiveness			PGM Individual-Level Effectiveness		
	n	**$\bar{X}$**	**SE**	**n**	**$\bar{X}$**	**SE**
Total	133	2.44	.062	133	2.93	.057
Whites	114	2.46	.070	113	2.95	.062
Blacks	19	2.37	.124	19	2.86	.171

Figure 6.2: Means for total *social construction* vignette sample and by race for RBM individual-level effectiveness and PGM individual-level effectiveness.

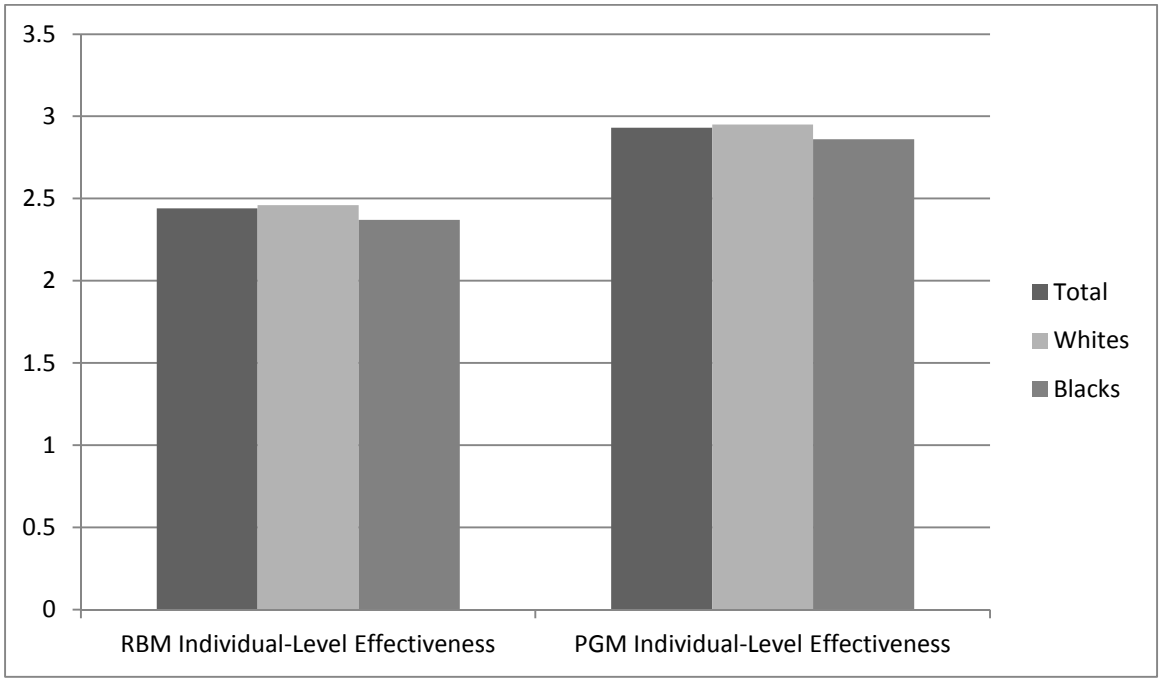


Table 6.10: Means and standard errors for RBM individual-level effectiveness and PGM individual-level effectiveness beliefs among the *race is genetic* vignette condition.

	RBM Individual-Level Effectiveness			PGM Individual-Level Effectiveness		
	n	**$\bar{X}$**	**SE**	**n**	**$\bar{X}$**	**SE**
Total	133	2.53	.068	133	2.93	.071
Whites	114	2.58	.073	114	3.02	.068
Blacks	19	2.20	.086	19	2.39	.117

Figure 6.3: Means for total *race is genetic* vignette sample and by race for RBM individual-level effectiveness and PGM individual-level effectiveness.

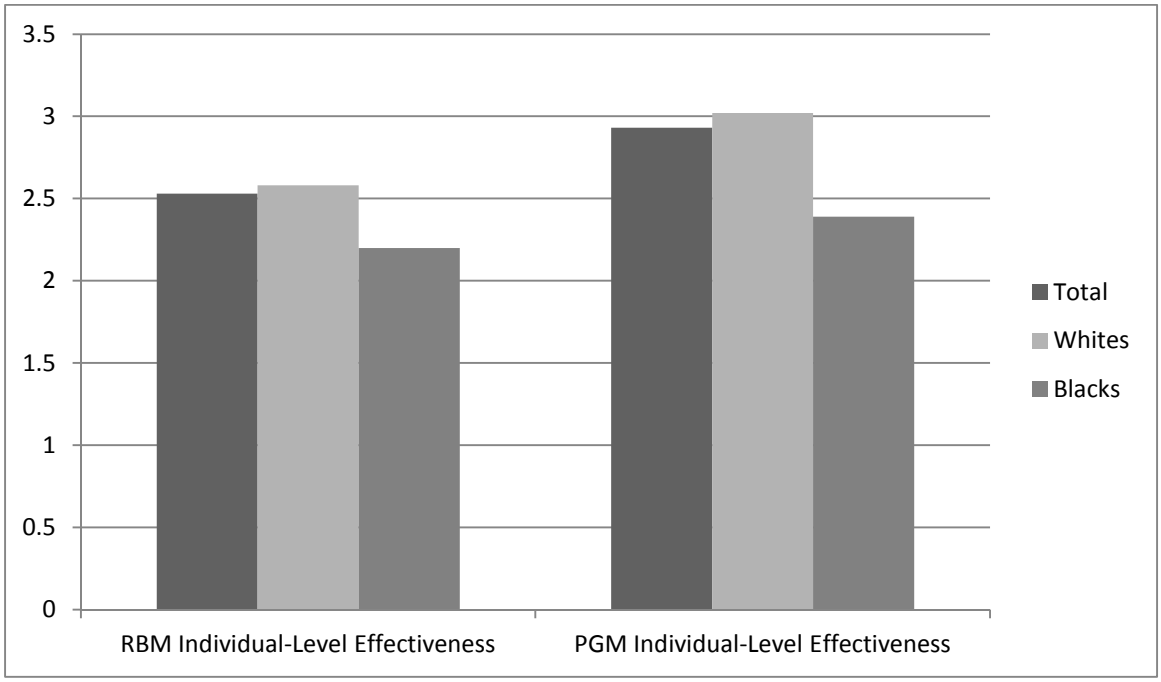


Table 6.11: Means and standard errors for RBM individual-level effectiveness and PGM individual-level effectiveness beliefs among the *admixture* vignette condition.

	RBM Individual-Level Effectiveness			PGM Individual-Level Effectiveness		
	n	**$\bar{X}$**	**SE**	**n**	**$\bar{X}$**	**SE**
Total	120	2.56	.082	121	2.82	.081
Whites	107	2.65	.068	108	2.90	.060
Blacks	13	1.85	.122	13	2.16	.102

Figure 6.4: Means for total *admixture* vignette sample and by race for RBM individual-level effectiveness and PGM individual-level effectiveness.

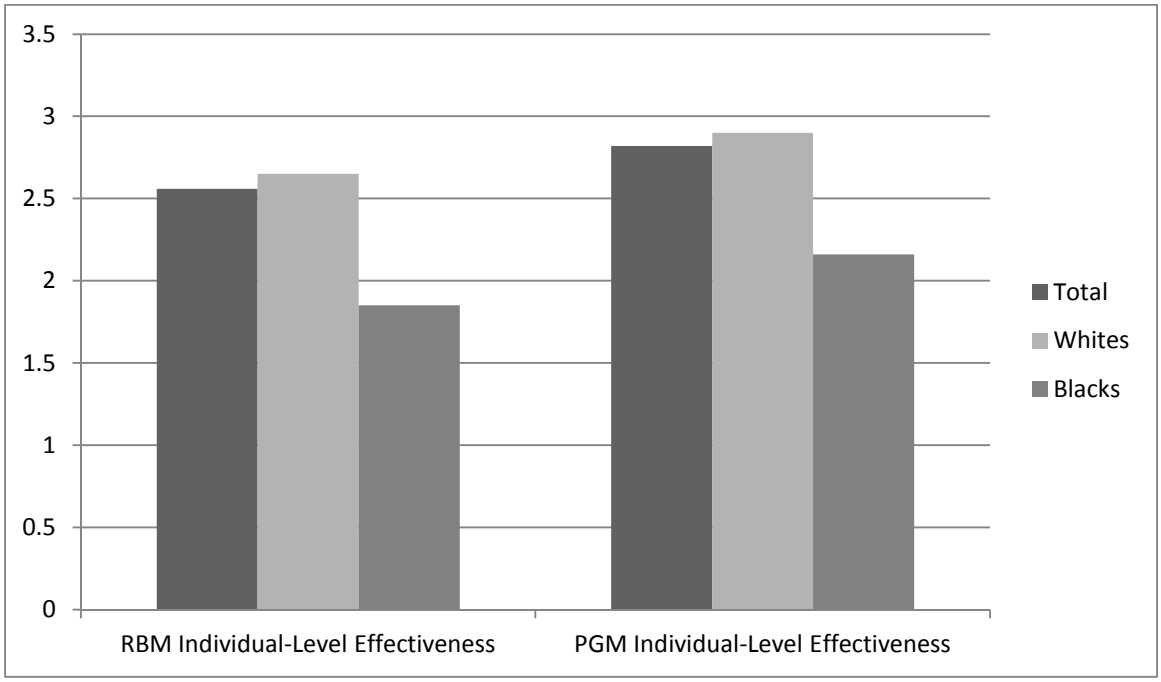
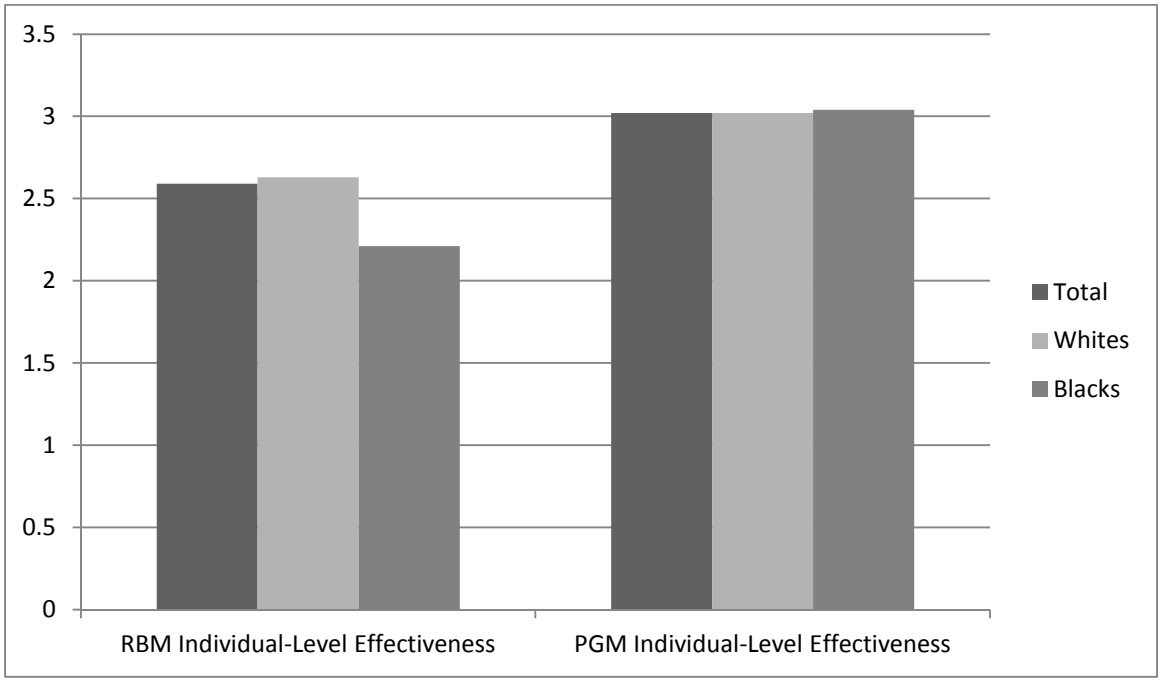


Table 6.12: Means and standard errors for RBM individual-level effectiveness and PGM individual-level effectiveness beliefs among the *genetic health difference* vignette condition.

	RBM Individual-Level Effectiveness			PGM Individual-Level Effectiveness		
	n	**$\bar{X}$**	**SE**	**n**	**$\bar{X}$**	**SE**
Total	159	2.59	.097	159	3.02	.085
Whites	143	2.63	.100	143	3.02	.093
Blacks	16	2.21	.311	16	3.04	.111

Figure 6.5: Means for total *genetic health difference* vignette sample and by race, for RBM individual-level effectiveness and PGM individual-level effectiveness.



Next, to examine the proportions of those who endorsed or did not endorse RBM individual-level effectiveness versus PGM individual-level effectiveness, I examined the frequencies for both measures. Table 6.13 presents the frequencies and means for both measures by *race vignette* condition and race. Greater proportions of both white and black respondents assigned to the *social construction* vignette, *genetic health difference* vignette and control condition believed that PGM would be effective at the individual level compared to the proportions who believed RBM would be effective at the individual level. In fact, at least 3 out of 4 white and black respondents assigned to one those three vignette conditions endorsed PGM's individual-level effectiveness, whereas approximately half or fewer white and black respondents endorsed RBM's individual-level effectiveness after exposure to one of these three vignette conditions. Notably, while similar proportions of white respondents assigned to the *race is genetic* or *admixture* vignette conditions endorsed these two beliefs in comparison to white respondents assigned to the other three vignette conditions, substantially smaller proportions of black respondents assigned to these two vignettes endorsed PGM individual-level effectiveness (respectively 20.0 and 23.1 percent) compared to both the proportion of white respondents in the *race is genetic* or *admixture* vignette conditions, as well as the proportion of black and white respondents assigned to the other three vignette conditions. In the case of black respondents assigned to the *admixture* vignette, a *smaller* proportion of black respondents in fact endorsed PGM individual-level effectiveness (23.1 percent) compared to the proportion of black respondents that endorsed RBM individual-level effectiveness (30.8 percent). The results indicate that the vignette experiment had some effect on black respondents' endorsement of PGM individual-level effectiveness in comparison to RBM individual-level effectiveness, but not on white respondents' comparative endorsement of the two measures.

If only the means and frequencies for the total sample of respondents were examined, the results show support for Hypothesis 7, which predicted that mean endorsement levels of PGM's effectiveness at the individual level would be greater than mean endorsement levels of RBM's effectiveness at the individual level. This was the case across the board for all vignette conditions. However, when we look at the means and frequencies by race, we see that for black respondents assigned to the *admixture* vignette, this was not the case. Although the mean for PGM individual-level effectiveness was higher than that of RBM individual-level effectiveness for black respondents assigned to the *admixture* vignette, the frequencies indicated that a smaller portion of black respondents endorsed PGM individual-level effectiveness (23.1 percent) compared to RBM individual-level effectiveness (30.8 percent).

Table 6.13: Frequencies and means for PGM individual-level effectiveness versus RBM individual-level effectiveness by *race vignette experiment* condition for total sample as well as by race.

	PGM Individual-Level Effectiveness Total Sample %	RBM Individual-Level Effectiveness Total Sample %	PGM Individual-Level Effectiveness Whites %	RBM Individual-Level Effectiveness Whites %	PGM Individual-Level Effectiveness Blacks %	RBM Individual-Level Effectiveness Blacks %
Control Condition	**(n = 85)**	**(n = 84)**	**(n = 74)**	**(n = 73)**	**(n = 11)**	**(n = 11)**
Agree	88.2	50.0	87.8	49.3	90.0	54.5
Neither Agree Nor Disagree	3.5	6.0	2.7	6.8	9.1	0
Disagree	8.2	44.0	9.5	43.8	0.0	45.5
$\bar{x}$	3.15	2.54	3.15	2.55	3.16	2.50
Social Construction	**(n = 133)**	**(n = 133)**	**(n = 114)**	**(n = 114)**	**(n = 19)**	**(n = 20)**
Agree	76.7	36.1	76.3	37.7	78.9	25.0
Neither Agree Nor Disagree	9.8	21.1	10.5	19.3	10.5	30.0
Disagree	13.5	42.9	13.2	43.0	10.5	45.0
$\bar{x}$	2.93	2.44	2.95	2.46	2.86	2.37
Race Is Genetic	**(n = 133)**	**(n = 133)**	**(n = 115)**	**(n = 114)**	**(n = 20)**	**(n = 19)**
Agree	66.9	43.6	73.9	49.1	20.0	10.5
Neither Agree Nor Disagree	11.3	12.8	11.3	12.3	15.0	15.8
Disagree	21.8	43.6	14.8	38.6	65.0	73.7
$\bar{x}$	2.93	2.53	3.02	2.58	2.39	2.20

Table 6.13: Frequencies and means for PGM individual-level effectiveness versus RBM individual-level effectiveness by *race vignette experiment* condition for total sample as well as by race.

	PGM Individual-Level Effectiveness Total Sample %	RBM Individual-Level Effectiveness Total Sample %	PGM Individual-Level Effectiveness Whites %	RBM Individual-Level Effectiveness Whites %	PGM Individual-Level Effectiveness Blacks %	RBM Individual-Level Effectiveness Blacks %
Admixture	**(n =121)**	**(n = 121)**	**(n = 108)**	**(n = 107)**	**(n = 13)**	**(n = 13)**
Agree	70.2	53.7	75.9	57.0	23.1	30.8
Neither Agree Nor Disagree	14.0	10.7	11.1	12.1	38.5	0.0
Disagree	15.7	35.5	13.0	30.8	38.5	69.2
$\bar{x}$	2.82	2.56	2.90	2.65	2.16	1.85
Genetic Health Difference	**(n = 159)**	**(n = 159)**	**(n = 144)**	**(n = 143)**	**(n = 16)**	**(n = 16)**
Agree	74.8	52.2	74.3	53.8	75.0	31.3
Neither Agree Nor Disagree	13.8	8.8	13.2	9.8	25.0	6.3
Disagree	11.3	39.0	12.5	36.4	0.0	62.5
$\bar{x}$	3.02	2.59	3.02	2.63	3.04	2.21

Table 6.14: Race-based medicine individual-level effectiveness crosstabulated with personalized genomic medicine individual-level effectiveness for the total sample, by race and vignette condition.

RBM Individual-Level Effectiveness	PGM Individual-Level Effectiveness								
	Total Sample			Whites			Blacks		
	Agree %	Neither Agree Nor Disagree %	Disagree %	Agree %	Neither Agree Nor Disagree %	Disagree %	Agree %	Neither Agree Nor Disagree %	Disagree %
Control Group		**n = 85**			**n = 74**			**n = 11**	
Agree	48.2	1.2	1.2	48.6	0.0	1.4	45.5	9.0	0.0
Neither Agree Nor Disagree	5.9	0.0	0.0	6.8	0.0	0.0	0.0	0.0	0.0
Disagree	34.1	2.4	7.1	32.4	2.7	8.1	45.5	0.0	0.0
Social Construction		**n = 133**			**n = 114**			**n = 19**	
Agree	32.3	1.5	2.3	34.2	1.8	1.8	21.1	0.0	5.3
Neither Agree Nor Disagree	16.5	3.0	1.5	14.0	3.6	1.8	31.6	0.0	0.0
Disagree	27.8	5.3	9.8	28.1	5.3	9.6	26.3	5.3	10.5
Race Is Genetic		**n = 134**			**n = 115**			**n = 19**	
Agree	40.3	2.2	0.7	46.1	2.6	0.9	10.5	0.0	0.0
Neither Agree Nor Disagree	7.5	3.7	1.5	7.0	3.5	1.7	10.5	5.3	0.0
Disagree	17.9	6.0	20.1	20.9	5.2	12.2	0.0	5.3	68.4

Table 6.14: Race-based medicine individual-level effectiveness crosstabulated with personalized genomic medicine individual-level effectiveness for the total sample, by race and vignette condition.

RBM Individual-Level Effectiveness	PGM Individual-Level Effectiveness								
	Total Sample			Whites			Blacks		
	Agree %	Neither Agree Nor Disagree %	Disagree %	Agree %	Neither Agree Nor Disagree %	Disagree %	Agree %	Neither Agree Nor Disagree %	Disagree %
Admixture		**n = 121**			**n = 107**			**n = 13**	
Agree	47.1	3.3	3.3	51.4	1.9	3.7	7.7	15.4	0.0
Neither Agree Nor Disagree	8.2	1.7	0.8	9.3	1.9	0.9	0.0	0.0	0.0
Disagree	14.9	9.1	11.6	15.0	7.5	8.4	15.4	23.1	38.5
Genetic Health Difference		**n = 159**			**n = 143**			**n = 16**	
Agree	49.7	2.5	0.0	51.0	2.8	0.0	31.3	0.0	0.0
Neither Agree Nor Disagree	5.7	0.6	2.5	5.6	0.7	2.8	6.3	0.0	0.0
Disagree	19.5	10.7	8.8	17.5	9.8	9.8	37.5	25.0	0.0

A crosstabulation analysis was conducted between responses for RBM individual-level effectiveness and PGM individual-level effectiveness by vignette condition as well as race. Table 6.14 presents the results of this analysis for the two measures. For the total sample and white sub-sample, we see that the majority of respondents within each vignette condition agreed with the belief that PGM is effective at the individual level, although among those who agreed with this belief there was variation in the extent to which respondents agreed or disagreed with RBM individual-level effectiveness belief. The range by vignette of white respondents who agreed that both RBM and PGM are effective at the individual level was from 32.3 percent (*social construction* vignette) to 49.7 percent (*genetic health difference* vignette).

There was fairly large variability between vignette conditions with respect to black respondents' concordance in beliefs between RBM and PGM individual-level effectiveness. The percentage of black respondents who agreed that both RBM and PGM are effective at the individual level ranged from a low of 7.7 percent (*admixture* vignette) to a high of 45.5 percent (control group). Meanwhile, the percentage of black respondents who disagreed with both RBM and PGM individual-level effectiveness beliefs varied even more by vignette condition, ranging from as low as 0 percent concordant disagreement with both beliefs (the control group and *genetic health difference* vignette) to as high as 68.4 percent concordant disagreement with both beliefs (the *race is genetic* vignette).

In order to assess to what extent individual respondents' PGM and RBM individual-level effectiveness beliefs differed, the RBM-PGM individual-level effectiveness difference score was calculated for each respondent. A positive difference score means that respondents on average believed RBM is more effective at the individual level than PGM. Likewise, a negative

difference score means respondents on average believed PGM is more effective than RBM. The larger the absolute value of a difference score, the greater the difference in belief in RBM's and PGM's effectiveness at the individual level. Tables 6.15-6.19 present means, standard deviations and Student's *t*-test statistics for the RBM-PGM individual-level effectiveness difference score for each of the *race vignette experiment's* conditions. Because an inspection of the means for each measure indicated that the vignette experiment may have had an effect on blacks' individual and comparative endorsement of the two measures, these analyses were intentionally separated by vignette condition.

Tables 6.15-6.19 *t*-test results indicate that the mean difference scores significantly differed from 0 for the total sample and the white and black sub-samples for each vignette condition. The only exception was black respondents assigned to the *admixture* vignette condition, whose mean difference score did not significantly differ from 0 at the .05-level but indicated that there likely was some difference between the two scores ($p < .10$). All of the mean values for the RBM-PGM individual-level effectiveness difference scores were negative indicating that on average, white and black respondents, regardless of the vignette condition to which they were assigned, believed that PGM is more effective at the individual level than RBM.

Table 6.15: Means, standard deviations, and Student's *t*-test statistic for RBM-PGM individual-level effectiveness difference score, for total control group sample and by race.

	n	$\bar{X}$	Standard Deviation	*t*
Total	85	-.6104	.783	-7.145***
Whites	73	-.6037	.819	-6.292***
Blacks	12	-.6546	.444	-4.888*

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Table 6.16: Means, standard deviations, and Student's *t*-test statistic for RBM-PGM individual-level effectiveness difference score, for total *social construction* vignette sample and by race.

	n	$\bar{X}$	Standard Deviation	*t*
Total	133	-.4936	.742	-7.680***
Whites	113	-.4933	.763	-6.871***
Blacks	19	-.4954	.608	-3.552**

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Table 6.17: Means, standard deviations, and Student's *t*-test statistic for RBM-PGM individual-level effectiveness difference score, for total *race is genetic* vignette sample and by race.

	n	$\bar{X}$	Standard Deviation	*t*
Total	133	-.3971	.755	-6.060***
Whites	114	-.4331	.779	-5.934***
Blacks	19	-.1854	.236	-3.429*

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Table 6.18: Means, standard deviations, and Student's *t*-test statistic for RBM-PGM individual-level effectiveness difference score, for total *admixture* vignette sample and by race.

	n	$\bar{X}$	Standard Deviation	*t*
Total	120	-.2609	.686	-4.165***
Whites	107	-.2537	.684	-3.841***
Blacks	13	-.3188	.565	-2.036†

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Table 6.19: Means, standard deviations, and Student's *t*-test statistic for RBM-PGM individual-level effectiveness difference score, for total *genetic health difference* vignette sample and by race.

	n	$\bar{X}$	Standard Deviation	*t*
Total	159	-.4315	.965	-5.641***
Whites	143	-.3876	.898	-5.161***
Blacks	16	-.8266	1.182	-2.795*

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Table 6.20 presents the estimates and standard errors for the RBM-PGM individual-level effectiveness difference score regressed on race, adjusting for socio-demographic variables and the *race vignette experiment* (Model 41). Because the frequencies for the two measures in Table 6.13 indicated that there may be a race by *race vignette experiment* interaction effect for comparative endorsement levels of RBM and PGM individual-level effectiveness beliefs, the RBM-PGM individual-level effectiveness difference score was also regressed on race by *race vignette experiment* interaction terms, adjusting for the same socio-demographic variables (Model 42). The results for both models indicate that overall, there was no significant difference between white and black respondents in the degree to which their RBM and PGM individual-level effectiveness beliefs differed, and there was no interaction effect between race and *race vignette experiment*.

Table 6.20: RBM-PGM individual-level effectiveness difference score regressed on race and race by *race vignette experiment* interactions terms, adjusting for sex, age, and education (n = 625).

	Model 41		Model 42	
	β	**SE**	**β**	**SE**
Intercept	-.520	.280	-.534†	.287
Black	-.053	.100	-.067	.163
Male	.014	.065	.009	.065
Age	-.002	.002	-.001	.002
Education	-.001	.024	-.001	.024
***Admixture* Vignette**	.345**	.107	.345**	.119
***Social Construction* Vignette**	.113	.107	.100	.120
***Race Is Genetic* Vignette**	.206†	.106	.164	.119
***Genetic Health Difference* Vignette**	.168	.114	.205†	.123
Black * *Admixture* Vignette	--	--	-.009	.255
Black * *Social Construction* Vignette	--	--	.077	.226
Black * *Race Is Genetic* Vignette	--	--	.303	.187
Black * *Genetic Health Difference* Vignette	--	--	-.362	.330

†$P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$.

6.3.2.2 PGM versus RBM Behavioral Orientation

Means, frequencies, crosstabulation, Student's *t*-test and multiple linear regression analyses were conducted to compare endorsement levels between PGM behavioral orientation

and RBM behavioral orientation. Tables 6.21 – 6.25 present the means and standard errors for RBM behavioral orientation and PGM behavioral orientation by *race vignette experiment* condition and race. Figures 6.6-6.10 chart the means for the total sample and the white and black sub-samples for each of the respective tables. The results indicate that PGM behavioral orientation sample means were somewhat to substantially higher than those for RBM behavioral orientation for each of the vignette conditions other than the *race is genetic* vignette condition. For this latter vignette condition, the PGM behavioral orientation means were slightly higher than the RBM behavioral orientation means for the total vignette sample and the white sub-sample. However for the black respondents assigned to this vignette, the PGM behavioral orientation mean was lower than the mean for RBM behavioral orientation. The results overall indicate support for Hypothesis 7, which hypothesized that PGM behavioral orientation endorsement levels will be greater than those for RBM behavioral orientation. But, while this was uniformly the case for white respondents regardless of the vignette condition to which they were exposed, vignette condition did seem to have an effect on the direction of RBM versus PGM behavioral orientation difference for the black respondents.

Table 6.21: Means and standard errors for RBM behavioral orientation and PGM behavioral orientation for the *race vignette experiment* control condition.

	RBM Behavioral Orientation			PGM Behavioral Orientation		
	n	**$\bar{X}$**	**SE**	**n**	**$\bar{X}$**	**SE**
Total	85	3.26	.076	85	3.57	.076
Whites	71	3.26	.112	74	3.58	.080
Blacks	11	3.22	.332	11	3.51	.148

Figure 6.6: Means for total *race vignette experiment* control condition sample and by race, for RBM behavioral orientation and PGM behavioral orientation.

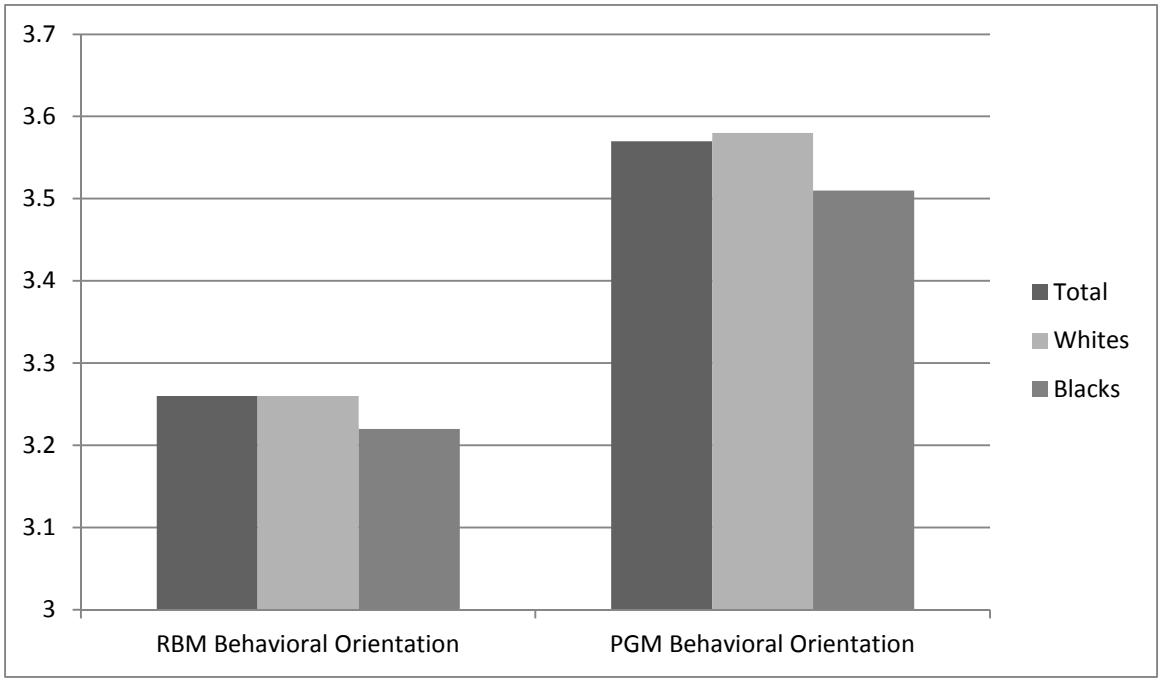


Table 6.22: Means and standard errors for RBM behavioral orientation and PGM behavioral orientation for the *social construction* vignette condition.

	RBM Behavioral Orientation			PGM Behavioral Orientation		
	n	**$\bar{X}$**	**SE**	**n**	**$\bar{X}$**	**SE**
Total	133	3.07	.088	131	3.40	.068
Whites	114	3.12	.091	111	3.40	.071
Blacks	19	2.79	.262	19	3.39	.189

Figure 6.7: Means for total *social construction* vignette sample and by race, for RBM behavioral orientation and PGM behavioral orientation.

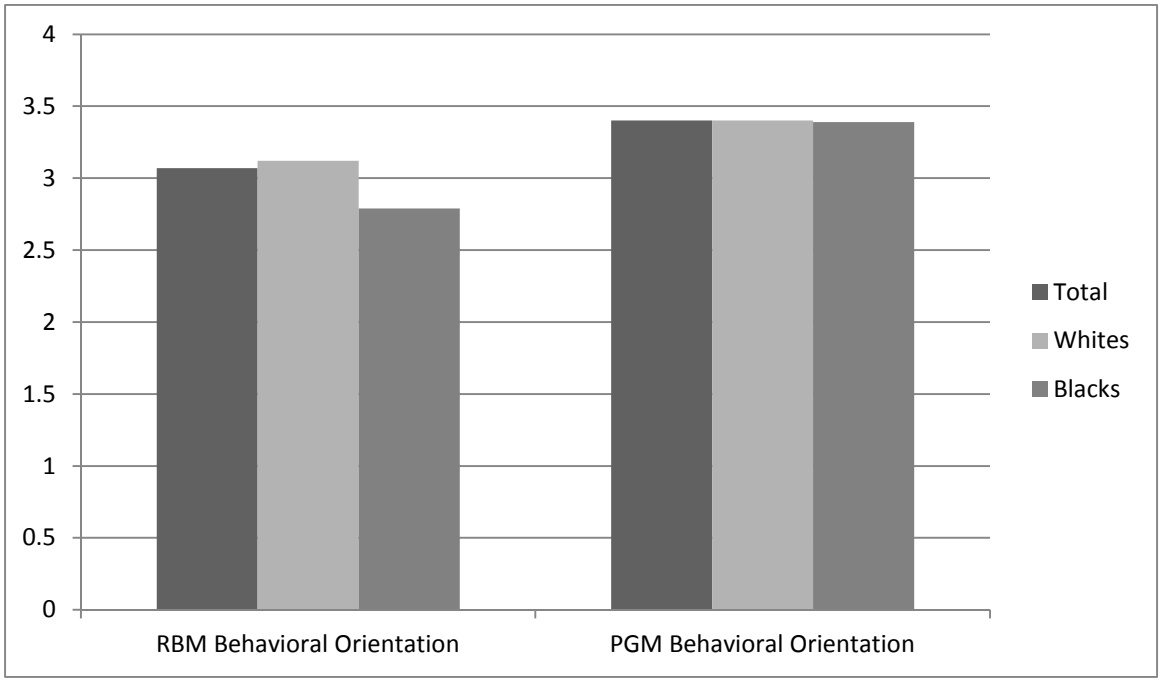


Table 6.23: Means and standard errors for RBM behavioral orientation and PGM behavioral orientation for the *race is genetic* vignette condition.

	RBM Behavioral Orientation			PGM Behavioral Orientation		
	n	**$\bar{X}$**	**SE**	**n**	**$\bar{X}$**	**SE**
Total	132	3.12	.103	133	3.24	.102
Whites	112	3.22	.104	114	3.39	.083
Blacks	19	2.55	.201	19	2.36	.193

Figure 6.8: Means for total *race is genetic* vignette sample and by race, for RBM behavioral orientation and PGM behavioral orientation.

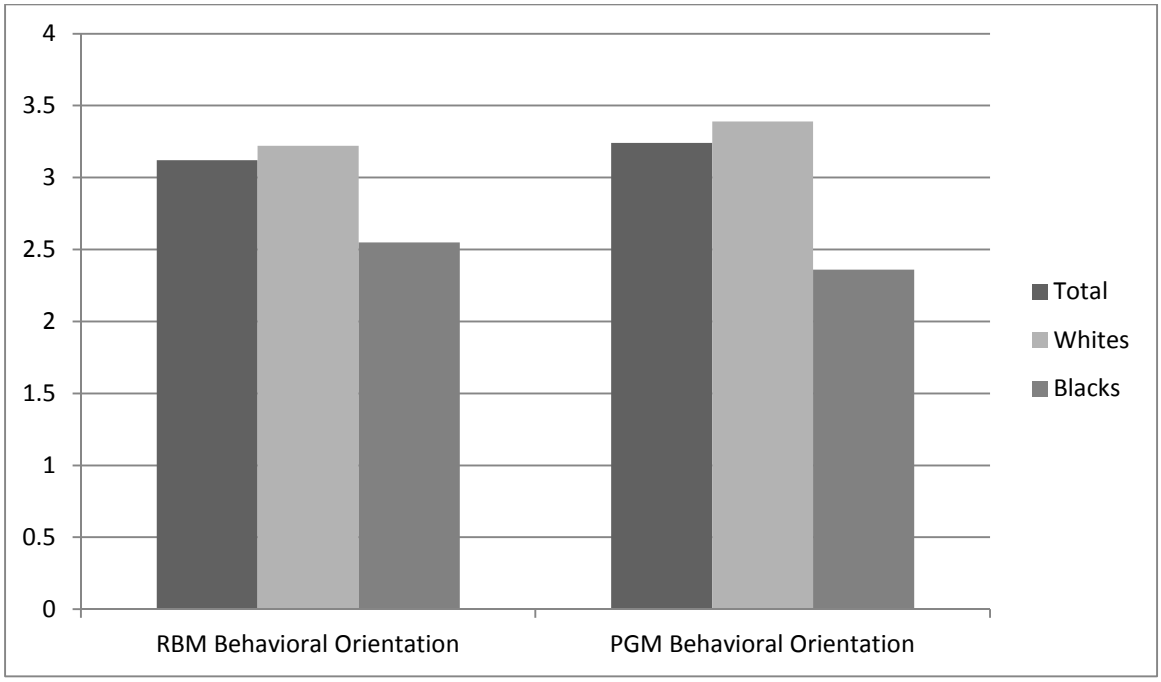


Table 6.24: Means and standard errors for RBM behavioral orientation and PGM behavioral orientation for the *admixture* vignette condition.

	RBM Behavioral Orientation			PGM Behavioral Orientation		
	n	**$\bar{X}$**	**SE**	**n**	**$\bar{X}$**	**SE**
Total	120	3.04	.112	121	3.30	.103
Whites	107	3.15	.090	108	3.39	.075
Blacks	13	2.14	.244	13	2.52	.144

Figure 6.9: Means for total *admixture* vignette sample and by race, for RBM behavioral orientation and PGM behavioral orientation.

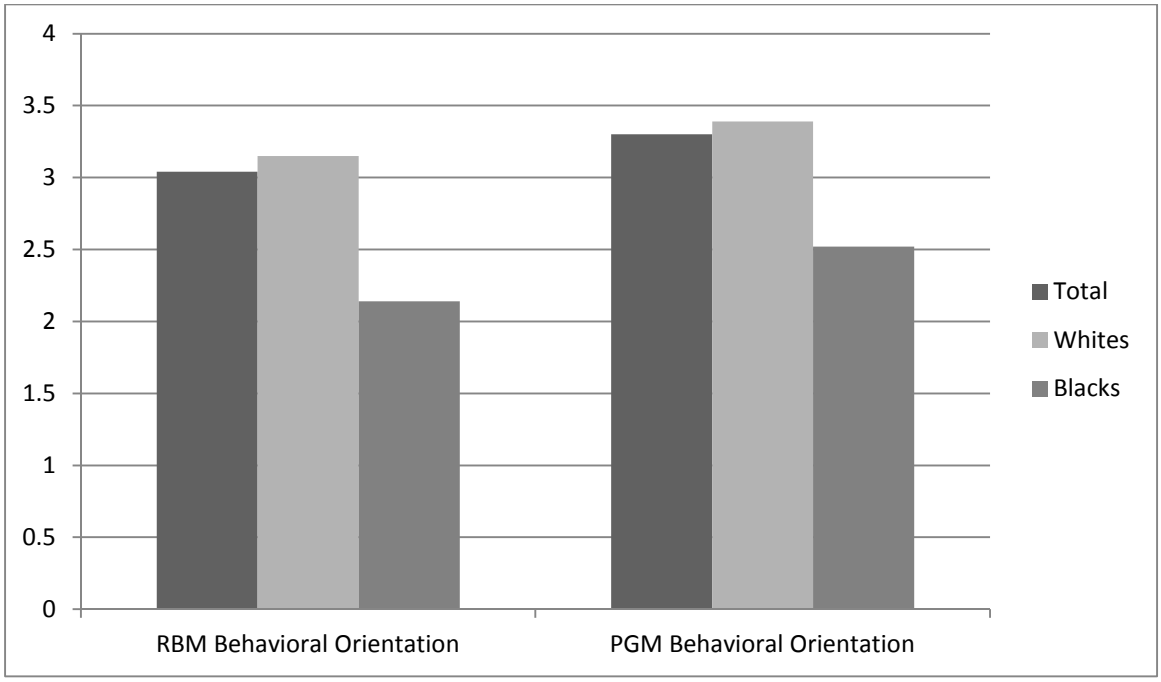


Table 6.25: Means and standard errors for RBM behavioral orientation and PGM behavioral orientation for the *genetic health difference* vignette condition.

	RBM Behavioral Orientation			PGM Behavioral Orientation		
	n	**$\bar{X}$**	**SE**	**n**	**$\bar{X}$**	**SE**
Total	158	3.08	.127	159	3.44	.121
Whites	142	3.11	.131	143	3.44	.133
Blacks	16	2.72	.431	16	3.49	.161

Figure 6.10: Means for total *genetic health difference* vignette sample and by race, for RBM behavioral orientation and PGM behavioral orientation.

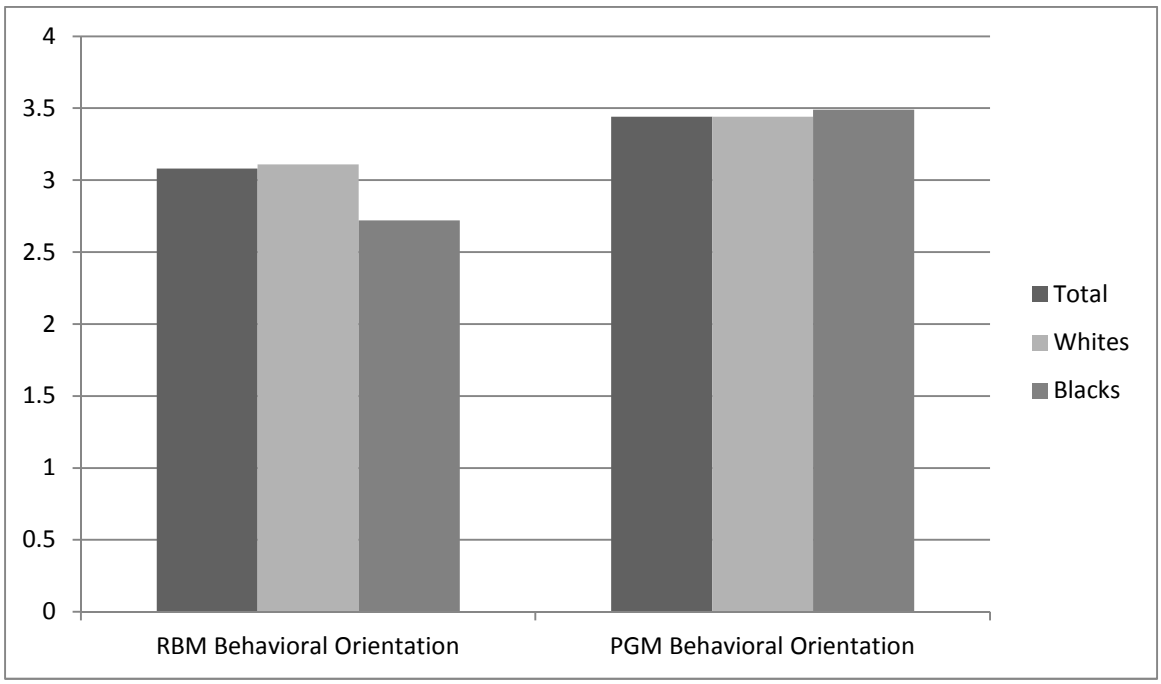


Table 6.26 reports the frequencies for PGM and RBM behavioral orientation by *race vignette experiment* condition for the total sample and by race. The frequencies results are similar to the results for the two measures' means. For all five vignette conditions, a higher proportion of the total sample and white sub-sample indicated preferences to use PGM compared to the proportion of both samples that preferred to use RBM. Notably, for the black sub-sample, preferences for using PGM were higher than preferences for using RBM among respondents assigned to the *social construction* vignette, *admixture* vignette, *genetic health difference* vignette and control condition. The frequencies for the two measures were reversed, however, for black respondents assigned to the *race is genetic* vignette. For this sub-sample there was a substantially smaller proportion of black respondents who indicated a preference for using PGM (35 percent) compared to RBM (60 percent).

Table 6.26: Frequencies for PGM behavioral orientation versus RBM behavioral orientation by *race vignette experiment* condition for the total sample and by race.

	PGM Behavioral Orientation Total Sample %	RBM Behavioral Orientation Total Sample %	PGM Behavioral Orientation Whites %	RBM Behavioral Orientation Whites %	PGM Behavioral Orientation Blacks %	RBM Behavioral Orientation Blacks %
Control Group	**(n = 85)**	**(n = 82)**	**(n = 73)**	**(n = 72)**	**(n = 11)**	**(n = 11)**
Somewhat/Strongly Agree	98.8	85.4	98.6	86.1	100.0	45.5
Somewhat/Strongly Disagree	1.2	14.6	1.4	13.9	0.0	54.5
$\bar{X}$	3.57	3.26	3.58	3.26	3.51	3.22
Social Construction	**(n = 130)**	**(n = 133)**	**(n = 112)**	**(n = 114)**	**(n = 20)**	**(n = 20)**
Somewhat/Strongly Agree	93.1	77.4	92.9	80.7	90.0	55.0
Somewhat/Strongly Disagree	6.9	22.6	7.1	19.3	10.0	45.0
$\bar{X}$	3.40	3.07	3.40	3.12	3.39	2.79
Race Is Genetic	**(n = 133)**	**(n = 131)**	**(n = 114)**	**(n = 112)**	**(n = 20)**	**(n = 20)**
Somewhat/Strongly Agree	81.2	76.3	88.6	78.6	35.0	60.0
Somewhat/Strongly Disagree	18.8	23.7	11.4	21.4	65.0	40.0
$\bar{X}$	3.24	3.12	3.39	3.22	2.36	2.55

Table 6.26: Frequencies for PGM behavioral orientation versus RBM behavioral orientation by *race vignette experiment* condition for the total sample and by race.

	PGM Behavioral Orientation Total Sample %	RBM Behavioral Orientation Total Sample %	PGM Behavioral Orientation Whites %	RBM Behavioral Orientation Whites %	PGM Behavioral Orientation Blacks %	RBM Behavioral Orientation Blacks %
Admixture	**(n = 121)**	**(n = 121)**	**(n = 108)**	**(n = 107)**	**(n = 14)**	**(n = 14)**
Somewhat/Strongly Agree	90.9	80.2	93.5	85.0	64.3	42.9
Somewhat/Strongly Disagree	9.1	19.8	6.5	15.0	35.7	57.1
$\bar{X}$	3.30	3.04	3.39	3.22	2.36	2.55
Genetic Health Difference	**(n = 160)**	**(n = 158)**	**(n = 143)**	**(n = 143)**	**(n = 16)**	**(n = 16)**
Somewhat/Strongly Agree	92.5	76.6	92.3	76.9	100.0	75.0
Somewhat/Strongly Disagree	7.5	23.4	7.7	23.1	0.0	25.0
$\bar{X}$	3.44	3.08	3.44	3.11	3.49	2.72

Table 6.27: RBM behavioral orientation crosstabulated with PGM behavioral orientation by *race vignette experiment* condition as well as race.

RBM Behavioral Orientation	PGM Behavioral Orientation					
	Total Sample		Whites		Blacks	
	Somewhat/ Strongly Agree %	Somewhat/ Strongly Disagree %	Somewhat/ Strongly Agree %	Somewhat/ Strongly Disagree %	Somewhat/ Strongly Agree %	Somewhat/ Strongly Disagree %
Control Group	**n = 82**		**n = 71**		**n = 11**	
Somewhat/Strongly Agree	84.1	1.2	84.5	1.4	81.8	0.0
Somewhat/Strongly Disagree	14.6	0.0	14.1	0.0	18.1	0.0
Social Construction	**n = 131**		**n = 112**		**n = 19**	
Somewhat/Strongly Agree	77.1	1.5	81.3	0.9	52.6	5.3
Somewhat/Strongly Disagree	15.3	6.1	11.6	6.3	36.8	5.3
Race Is Genetic	**n = 131**		**n = 111**		**n = 20**	
Somewhat/Strongly Agree	71.8	4.6	78.4	0.9	35.0	25.0
Somewhat/Strongly Disagree	9.9	13.7	11.7	9.0	0.0	40.0
Admixture	**n = 120**		**n = 106**		**n = 14**	
Somewhat/Strongly Agree	79.2	1.7	84.0	1.9	42.9	0.0
Somewhat/Strongly Disagree	10.8	8.3	9.4	4.7	21.4	35.7

Table 6.27: RBM behavioral orientation crosstabulated with PGM behavioral orientation by *race vignette experiment* condition as well as race.

RBM Behavioral Orientation	PGM Behavioral Orientation					
	Total Sample		Whites		Blacks	
	Somewhat/ Strongly Agree %	Somewhat/ Strongly Disagree %	Somewhat/ Strongly Agree %	Somewhat/ Strongly Disagree %	Somewhat/ Strongly Agree %	Somewhat/ Strongly Disagree %
Genetic Health Difference	**n = 157**		**n = 142**		**n = 15**	
Somewhat/Strongly Agree	76.4	0.6	76.8	0.7	73.3	0.0
Somewhat/Strongly Disagree	16.6	6.4	15.5	7.0	26.7	0.0

Table 6.27 presents the results of RBM behavioral orientation crosstabulated with PGM behavioral orientation by *race vignette experiment* condition and race. Although among whites the vast majority of respondents, regardless of vignette condition, agreed that they would prefer to use both RBM and PGM, among blacks, there was much greater variability between vignette conditions. Preferences for using both RBM and PGM ranged from a low of 35.0 percent (*race is genetic* vignette) to 81.8 percent (control group) among the black respondents. Rejecting the use of either RBM or PGM also varied from 0 percent (control group and *genetic health condition* vignette) to 40.0 percent (*race is genetic* vignette). The results therefore indicate some type of interaction effect between race and the vignette experiment for concordance in attitudes towards using RBM and PGM.

Tables 6.28-6.32 present means, standard deviations and Student's *t*-test statistics for the RBM-PGM behavioral orientation difference score for each of the *race vignette experiment's* conditions. Once again, a positive mean value for the difference score indicates that respondents on average preferred to use RBM over PGM, and a negative mean value indicates that respondents on average preferred to use PGM over RBM.

The mean values for the RBM-PGM behavioral orientation difference score for white respondents were negative for all vignette conditions, indicating that on average, white respondents preferred to use PGM over RBM regardless of the vignette condition to which they were assigned. For black respondents, the means for the RBM-PGM behavioral orientation difference score were negative for all vignette conditions except the *race is genetic* vignette. For this latter vignette, the mean was positive (.1922), indicating that black respondents assigned to this particular vignette on average preferred to use RBM over PGM.

The *t*-test results for the white sub-sample were statistically significant for each of the vignette conditions, indicating that the mean difference scores for behavioral orientation significantly differed from 0. This suggests that regardless of the vignette condition, white respondents were significantly more likely to prefer to use PGM over RBM. The *t*-tests for the black sub-sample, however, indicated that the vignette experiment had an effect on the extent to which respondents' PGM and RBM behavioral orientation scores differed. The *t*-test results for respondents assigned to the *social construction* vignette and the *genetic health difference* vignette were statistically significant, suggesting that black respondents assigned to those two vignette conditions had significantly greater preferences for using PGM compared to RBM. However, the mean RBM-PGM behavioral orientation difference scores were not significantly

different from 0 for respondents assigned to *admixture, race is genetic,* and the control group vignette conditions. The results of the Student's *t*-test analyses suggest a possible interaction effect between race and the *race vignette experiment* for differences between preferences for using PGM versus RBM.

Table 6.28: Means, standard deviations, and Student's *t*-test statistic for RBM-PGM behavioral orientation difference score, for total control group sample and by race.

	n	$\bar{X}$	Standard Deviation	*t*
Total	82	-.3298	.897	-3.328**
Whites	71	-.3359	.934	-3.029**
Blacks	11	-.2911	.632	-1.528

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Table 6.29: Means, standard deviations, and Student's *t*-test statistic for RBM-PGM behavioral orientation difference score, for total *social construction* vignette sample and by race.

	n	$\bar{X}$	Standard Deviation	*t*
Total	130	-.3164	.871	-4.141***
Whites	111	-.2658	.815	-3.432**
Blacks	19	-.6086	.670	-3.963**

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Table 6.30: Means, standard deviations, and Student's *t*-test statistic for RBM-PGM behavioral orientation difference score, for total *race is genetic* vignette sample and by race.

	n	$\bar{X}$	Standard Deviation	*t*
Total	132	-.1286	.803	-1.839†
Whites	112	-.1841	.692	-2.815**
Blacks	19	.1922	.348	2.408†

$^{\dagger}P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$.

Table 6.31: Means, standard deviations, and Student's *t*-test statistic for RBM-PGM behavioral orientation difference score, for total *admixture* vignette sample and by race.

	n	$\bar{X}$	Standard Deviation	*t*
Total	120	-.2427	.787	-3.381**
Whites	106	-.2251	.685	-3.384**
Blacks	13	-.3837	1.153	-1.199

$^{\dagger}P < .10$, *$P < .05$, **$P < .01$, ***$P < .001$.

Table 6.32: Means, standard deviations, and Student's *t*-test statistic for RBM-PGM difference score, for total *genetic health difference* vignette sample and by race.

	n	$\bar{X}$	Standard Deviation	*t*
Total	158	-.3704	1.388	-3.355**
Whites	142	-.3260	1.374	-2.827**
Blacks	16	-.7688	1.370	-2.246*

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

Table 6.33 presents the results for the RBM-PGM behavioral orientation difference score regressed on race (Model 41). The estimate for the black dummy variable was not statistically significant, indicating that overall, blacks and whites did not significantly differ in the magnitude of the difference scores, even after controlling for the *race vignette experiment*. In Model 42, the RBM-PGM behavioral orientation difference score is regressed on race by *race vignette experiment* interaction terms in order to see if there were racial differences in the vignette experiment's effect on differences in preferences for using RBM versus PGM. Despite there seeming to be an interaction effect between race and *race vignette experiment* according to the descriptive statistical analyses, the results of Table 6.33's Model 42 indicate that there was no interaction effect between race and the *race vignette experiment*.

Table 6.33: RBM-PGM behavioral orientation difference score regressed on race and race by *race vignette experiment* interactions terms, adjusting for sex, age, and education (n = 618).

	Model 41		Model 42	
	β	**SE**	**β**	**SE**
Intercept	-.116	.286	-.188	.287
Black	-.109	.143	.023	.222
Male	.107	.082	.094	.081
Age	-.003	.003	-.003	.002
Education	-.008	.025	-.005	.025
***Admixture* Vignette**	.080	.120	.108	.126
***Social Construction* Vignette**	.028	.123	.075	.133
***Race Is Genetic* Vignette**	.187	.118	.142	.125
***Genetic Health Difference* Vignette**	-.063	.140	-.010	.151
Black * *Admixture* Vignette	--	--	-.214	.438
Black * *Social Construction* Vignette	--	--	-.331	.318
Black * *Race Is Genetic* Vignette	--	--	.317	.326
Black * *Genetic Health Difference* Vignette	--	--	-.437	.403

$^{\dagger}P < .10$, $*P < .05$, $**P < .01$, $***P < .001$.

6.4 Discussion

6.4.1 Personalized Genomic Medicine Beliefs and Attitudes

Findings from prior studies have been mixed as far as evidence indicating that there are racial differences regarding PGM-related beliefs and attitudes. Some studies have suggested that blacks and other racial/ethnic minority groups have at times been found to hold favorable beliefs and attitudes with respect to the safety and clinical effectiveness of PGM specifically, and other genetic biomedical applications more generally. One focus group study that examined potential racial differences in PGM-related beliefs and attitudes found that black study participants generally believed PGM would lead to fewer side effects and less trial and error when prescribing, which were beliefs that were not discussed to the same extent among whites in the study (Marco, 2010). Bevan et al.'s (2003) study examining attitudes towards PGM and RBM found that blacks, like whites, overwhelmingly supported using PGM over RBM if given the choice. Another study that employed a randomized vignette experimental design to compare and contrast PGM-, RBM- and conventional medicine-related beliefs and attitudes found few racial differences in PGM and RBM-related beliefs and attitudes (Butrick et al., 2011). In contrast to prior studies that have suggested that blacks and other racial and ethnic minority populations hold favorable beliefs and attitudes regarding PGM, other studies did find racial differences to indicate more negative attitudes towards PGM-related issues, including genetic testing among racial and ethnic minority respondents compared to whites respondents (Hipps et al., 2003; Thompson et al., 2003).

The results from this dissertation study indicate white and black Americans generally hold favorable beliefs and attitudes towards PGM. Despite the overall favorable attitudes

towards PGM among white and black Americans in this study, racial differences were found in beliefs regarding the effectiveness of PGM and orientation towards using PGM. The evidence also suggests that whites systematically endorse PGM's individual-level effectiveness and preferences for using PGM at higher levels than blacks. Notably, more than half of the black sub-sample endorsed PGM's effectiveness at the individual level, however, this was substantially less than the proportion of whites who endorsed PGM individual-level effectiveness. In fact, there was a 20 percentage point difference in the proportion of whites (76.9 percent) versus the proportion of blacks (57.0 percent) who endorsed PGM's individual-level effectiveness. A multiple linear regression analysis confirmed that whites were significantly more likely than blacks to endorse PGM's individual-level effectiveness. Even greater proportions of both sub-samples indicated a preference for using PGM, although once again, there was a substantial difference between the proportion of whites (92.7 percent) and the proportion of blacks (75.9 percent) who indicated that they would prefer to use RBM. Multiple linear regression results again showed that whites were significantly more likely to prefer to use PGM than blacks.

The finding that a greater proportion of whites and blacks would prefer to use PGM compared to the proportion of both sub-samples that endorse PGM's individual-level effectiveness is similar to the finding in Chapter 4's examination of baseline RBM-related beliefs and attitudes, which showed that substantially more white and black respondents indicated they would prefer to use RBM compared to the number of respondents who endorsed RBM's effectiveness at the individual level. However, unlike the findings in Chapter 4 that showed few differences among whites, blacks and Hispanics regarding RBM individual-level effectiveness belief and behavioral orientation, there were statistically significant differences between white

and black respondents regarding PGM individual-level effectiveness belief and behavioral orientation.

Another notable finding was the interaction effect between race and education for both PGM individual-level effectiveness belief ($p < .10$) and PGM behavioral orientation ($p < .05$). As educational attainment increased for the black sub-sample, there was a greater likelihood of endorsing PGM's effectiveness and preferring to use PGM. However, there was no association between education and PGM beliefs and behavioral orientation among the white sub-sample. Although this interaction effect does not account for the overall racial difference seen in these two PGM-related constructs, it does suggest that a variety of socio-economic indicators are at play in understanding the extent to which Americans of different backgrounds endorse the potential effectiveness of PGM and their orientation towards using PGM if it was available. This latter finding may warrant future inquiry as it taps in to not only racial and socio-economic differences specific to PGM-related beliefs and attitudes, but possibly also differences in beliefs and attitudes relating to medicine and health care more generally. The race-education interaction suggests that less-educated black Americans may be more resistant towards using new biomedical treatments and technologies, even if such treatments and tools are personalized to meet the health-related needs of individuals.

Why there would be overall differences between white and black Americans regarding PGM-specific beliefs and attitudes also deserves some attention. As previously noted, several studies have shown that blacks and other racial and ethnic minority groups have more concerns about PGM specifically - and genetic research and testing more broadly - than whites in the U.S (Hipps et al., 2003; Thompson et al., 2003). These concerns have focused on a variety of issues

including cost, discrimination and physician mistrust related to the prescription and use of PGM and genetic testing. Although these concerns were specific to PGM, genetic testing and related research, notably, they are similar to concerns that have been expressed by black Americans and other racial and ethnic minority groups about health care and health research more broadly (Hunt, 2007; Lillie-Blanton, Brodie, Rowland, Altman & McIntosh, 2000; Popay et al., 2003; Rigby, Soss, Booske, Rohan & Robert, 2009; Robert, 2011; Schnittker, Freese & Powell, 2000). Mistrust towards medical authority remains especially salient for blacks in the U.S., and these feelings of mistrust towards the medical establishment have perhaps carried over into beliefs about the effectiveness of new biomedical applications and preferences for using these news tools and treatments, even if such technologies are tailored to the genomic profile of individuals (Jacobs, Rolle, Ferrans, Whitaker & Warnecke, 2006; LaVeist, Nickerson & Bowie, 2000). The findings in this study confirm the white-black disparity in endorsement of PGM and health-related genetic applications seen in several other studies. Although respondents were not specifically asked about perceived benefits and concerns regarding PGM in this study, these findings indicate that nationally, black Americans may have more concerns than whites regarding PGM.

In the context of the larger debate regarding causes of, and solutions to address, racial health disparities in the U.S. and globally, the finding that whites are more likely than blacks to endorse the effectiveness of PGM and indicate a preference to use PGM, has several implications. First, with respect to the efforts to make PGM the paradigm for how medicine is practiced, health care providers and related stakeholders may face some challenges as far as encouraging black Americans – and potentially other racial and ethnic minority populations – to believe that PGM can be effective and to use PGM. This study found that slightly less than half

of the black respondents did not believe PGM would be effective at the individual level, and 1 out of 4 black Americans indicated that they would not prefer to use PGM. The benefits of personalizing medical care based on individuals' genomic profiles may seem obvious to health care providers who are familiar with not only the epidemiological evidence that shows poorer morbidity and mortality outcomes among racial and ethnic minorities, but also the medical evidence that available treatments are often less effective among these populations. These benefits, however, may not be particularly evident to the lay public. Blacks' and other racial and ethnic minorities' concerns regarding the effectiveness and use of PGM, as cited in previous qualitative studies examining the American lay public's beliefs and attitudes regarding PGM, may be similar to, if not consistent with, their concerns overall regarding access to and the quality of health care in general.

This last point leads to the second implication of the finding that whites and blacks differ in their beliefs and attitudes regarding PGM. If health care providers, public health planners, policy makers and other related stakeholders are facing similar belief and attitudinal barriers regarding PGM to those regarding health promotion and health care more generally, then the paradigm shift towards PGM as the standard of medical care may have minimal benefits towards improving disparities in health outcomes if there are not concurrent efforts to address the larger concerns that minority populations continue to face. These concerns include cost, discrimination, and mistrust towards medical authority, all of which have been cited in previous studies examining beliefs and attitudes regarding PGM and genetic testing specifically, and access to and the quality of health care more broadly (Hipps et al., 2003; Robert & Booske, 2011; Thompson et al., 2003).

In the context of efforts to improve racial and ethnic health inequalities, these findings provide insight in to some of the challenges that health care providers and other stakeholders may face even as new treatments and biomedical technologies are introduced to improve the delivery of medicine to racially, ethnically, and genomically diverse populations. If PGM is indeed the future of medicine, then it is worthwhile to better understand the race-specific differences between blacks and whites that lead to half of black Americans not believing PGM would be effective at the individual level and one quarter not wanting to use PGM. Future research may therefore be warranted to examine reasons for why blacks in the U.S. are less likely to endorse PGM effectiveness and use PGM than whites.

6.4.2 Comparing Personalized Genomic Medicine and Race-Based Medicine Individual-Level Effectiveness Beliefs

Bevan and colleagues in their 2003 study comparing beliefs and attitudes regarding RBM, PGM and the usual course of treatment found that study respondents of all racial and ethnic backgrounds overwhelmingly supported PGM (75 percent of total sample) over RBM (4 percent) or the usual course of treatment (9 percent). In order to see if the results of a nationally representative sample of Americans would support or contradict the findings of Bevan et al.'s focus group study on RBM- and PGM-related beliefs and attitudes, I compared the RBM- and PGM-related beliefs and attitudes of black and white respondents in this study. The results of this dissertation study, in fact, support Bevan et al.'s findings that white and black Americans endorsed PGM at greater levels than RBM.

The findings showed that regardless of the vignette to which respondents were exposed, proportionally more white and black respondents endorsed PGM individual-level effectiveness

than RBM individual-level effectiveness. Means, frequencies and Student's *t*-tests of RBM-PGM individual-level effectiveness difference scores collectively indicated that a greater proportion of white and black respondents believed PGM is effective at the individual level compared to RBM. However, for the black respondents, exposure specifically to the *admixture* or *race is genetic* vignettes seemed to be associated with lower mean scores for PGM individual-level effectiveness compared to mean scores for black respondents assigned to the other vignettes. It is unclear as to why this would be the case since both vignettes specifically discussed the relationship between race and genetics, which is at most, tangentially related to PGM. Nonetheless, the lower means and smaller difference between PGM and RBM individual-level effectiveness beliefs among black respondents exposed to the *admixture* or *race is genetic* vignettes is worth noting because it suggests for one, that mass media messages about race and genetics can have an effect on PGM-related beliefs even though the topic is not directly related, and two, that such messages can have differential effects on PGM-related beliefs depending on the race or ethnicity of individuals. Also notable is the question of why messages that imply (in the case of the *admixture* vignette) or state (in the case of the *race is genetic* vignette) that there is some genetic basis to the concept of race would cause black respondents to be less likely to endorse PGM's individual-level effectiveness than respondents not exposed to such messages. The lower RBM individual-level effectiveness scores for black respondents assigned to the *race is genetic* and *admixture* vignette conditions could potentially be explained by a rejection of the *race is genetic* message and an interpretation of the *admixture* message that while there is some genetic basis to race, most Americans are of mixed race and therefore race-targeted pharmaceutical products are unlikely to be clinically effective for most Americans. However, even if the majority of black respondents interpreted these two vignette messages as such, it

remains unclear as to why there would be lower belief levels for PGM's individual-level effectiveness compared to those for the other three vignette conditions. Because there has been a steady increase in the volume of mass media messages about race and genetics, further research may also be warranted to examine mass media's effect on PGM-related beliefs and attitudes with a particular focus on potential racial differences as a consequence of these media messages (Phelan et al., 2013; Phelan et al., under review).

As predicted in Hypothesis 7, the total sample's means for PGM individual-level effectiveness were higher than its means for RBM individual-level effectiveness. This was the case regardless of the race of respondents or the vignette condition to which they were assigned. A plausible explanation for this difference is that a sizable portion of respondents are hesitant to endorse the idea that effective treatments can be developed for different racial groups, considering the fact that the idea of a biological or genetic basis to race remains highly controversial. Meanwhile regarding PGM, many may infer that treatments personalized to individuals' genomic profiles are logically more likely to be effective than treatments designed for much broader populations of people, however such populations are defined. A combination of these two beliefs should subsequently lead to greater endorsement of PGM individual-level effectiveness than RBM individual-level effectiveness.

Although the results from this study showed that whites on average endorse PGM individual-level effectiveness belief at significantly higher levels than blacks, they also showed that whites and blacks did not significantly differ in the magnitude (or direction) of RBM-PGM individual-level effectiveness belief difference scores. These findings, nonetheless, confirm

Bevan et al.'s (2003) study that both white and black respondents are more likely to believe that PGM is effective at the individual level than RBM.

6.4.3 Comparing Personalized Genomic Medicine and Race-Based Medicine Behavioral Orientations

The results for comparing PGM behavioral orientation with RBM behavioral orientation indicate that there are some differences between whites and blacks in their orientation towards using PGM versus RBM, although multiple linear regression results did not confirm that there was an overall racial difference in magnitude or direction of the degree of difference in behavioral orientation levels for PGM versus RBM. Whites consistently indicated higher mean preference levels for using PGM than RBM regardless of the *race vignette experiment* condition to which they were assigned. Black respondents had higher mean preference levels for using PGM compared to RBM for all vignette conditions except the *race is genetic* vignette. For this latter vignette condition, the mean score for PGM behavioral orientation was lower than the mean for RBM behavioral orientation. Although the Student's *t*-test results for white respondents' RBM-PGM behavioral orientation difference scores indicated that the scores were significantly different from 0 for all five vignette experiment conditions, black respondents' *t*-test results indicated that their behavioral orientation difference scores were only significantly different from 0 for those who were assigned to the *social construction* or *genetic health difference* vignette conditions.

On the one hand, these results suggest that differing mass media messages about race and genetics have the ability to increase or decrease the degree of difference in preference levels for PGM compared to RBM. They also suggest that these effects seem to be unique to blacks in

comparison to whites. This was the case for not only the analytical comparisons between RBM and PGM behavioral orientation but also comparisons between RBM and PGM individual-level effectiveness beliefs. On the other hand, the sample sizes for black respondents in each vignette condition were small with limited statistical power to detect differences in the Student's *t*-test results. Although it is possible that increasing the sample sizes for black respondents would not lead to different results, it is also possible that true differences in PGM versus RBM behavioral orientations, regardless of the vignette condition to which black respondents were exposed, were not evident for the control, *race is genetic* vignette or *admixture* vignette conditions because of the small sample sizes for black respondents. Because weak statistical power tends to attenuate true differences if such differences exist, it is possible that the lack of statistically significant differences between RBM and PGM behavioral orientation for black respondents assigned to the control, *race is genetic* vignette or *admixture* vignette conditions is a result of the small sample sizes. If that is in fact the case, then differences in orientations towards using RBM and PGM actually exist among black respondents regardless of their exposure to messages about the relationship between race and genetics.

Hypothesis 7 predicted that respondents would be more likely to prefer to use PGM than RBM. The findings from this study confirmed that this was the case for the white respondents, but it was not consistently the case for black respondents depending on the *race vignette experiment* condition to which they were assigned.

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In the context of the debate regarding how best to address health inequalities, there is hope that PGM will eliminate disparities in the types of treatments available and offered to

diverse racial and ethnic populations (Collins, 1999; Davies, 2006; Vera-Ramirez et al., 2010; Winkelmann and Herrington, 2010). If PGM is the future of medicine, then it is crucial to better understand and address the reasons for why some black Americans may be skeptical about the effectiveness of PGM and reluctant to use PGM. This study, as the first nationally representative study to examine beliefs and attitudes regarding both RBM and PGM, confirms previous exploratory studies that indicated that black Americans and other racial and ethnic minority populations are less likely to endorse PGM's effectiveness and less likely to prefer to use PGM compared to white Americans. More research, however, is needed to both better understand and address the reasons for why black Americans endorse PGM at lower rates than whites.

Chapter 7:

DISCUSSION

7.1 Introduction

As efforts continue to develop PGM as an important component – if not the standard – of medicine, efforts to develop and market RBM as an acceptable "interim" alternative for PGM also continue. RBM remains as controversial today as it did when BiDil was first proposed, and then approved, as the U.S.'s first race-targeted medication. Many within the academic and clinical communities question the effectiveness of race-specific treatments and are concerned with numerous negative consequences, such as the (re)geneticization of race and its various social and political implications (Foster, Sharp & Mulvihill, 2001; Duster, 2005; Kahn 2006a, 2006b; Ng et al., 2008; Phelan et al., 2013). Furthermore, there is the question of whether the future of diagnostic tools and drug development is truly about treating the individual patient or if it is increasingly more about treating populations. This question is due to the continued focus on the development of RBM and no clear indication that individual genomic maps will be used for personalizing treatments in the near future. If the for-profit pharmaceutical industry remains concerned about increasing its market share, then it makes sense for the industry to focus on developing drugs and diagnostic tools that are supposedly effective for use by large-scale populations, such as those defined by race or ethnicity. This strategy, however, is in conflict with the idea of treating the individual, which is the goal of PGM. Therefore, not only is it likely that the development of RBM will continue, but unless something prompts a large-scale paradigmatic shift away from developing RBM, it is possible that this "interim" form of PGM could permanently become the way in which PGM is envisioned. The cost of mapping

individuals' genomes has dropped dramatically in recent years, thus, it is possible that a concerted effort to use individual genomic maps to guide the development of pharmaceutical products could prompt a shift away from RBM towards PGM. This effort, however, remains to be seen.

Consequently, as RBM continues to develop, questions of whether the lay public believes RBM could be effective and whether the public would be willing to use RBM remain relevant. RBM's uptake by patients will be affected by the extent to which the lay public believes RBM could be clinically effective and whether they would prefer to use RBM over currently available forms of treatments. Furthermore, proponents of RBM qualify its value by asserting that RBM will help address racial and ethnic health disparities through the development of diagnostic tools and treatments that more effectively address the health and medical needs of racial and ethnic minority populations. Regardless of one's position regarding RBM, this argument causes both proponents and opponents of RBM alike to pause and consider the argument's merits. As the health divide continues to persist between white and racial and ethnic minority Americans, increased availability of and access to quality health care treatments for underserved populations are among the many needs that must be met in order to address disparities and improve population health. However, there is scant knowledge about the American public's beliefs and attitudes regarding RBM, both for the population as a whole and by the race and ethnicity of individuals. As the biomedical industry moves forward to develop RBM, consideration must be given to the American public's beliefs and attitudes, since public conceptions about RBM's effectiveness could impact its acceptance and usage.

This dissertation study examined several questions related to public conceptions regarding RBM and its relationship to PGM. Does the American public believe RBM could be an effective form of treatment? Would they use RBM? Do they believe RBM would help address racial and ethnic health disparities? Are there racial and ethnic differences in these beliefs and attitudes? Can mass media influence RBM-related beliefs and attitudes? And finally, how do lay conceptions regarding RBM compare to those of PGM?

This dissertation study was divided into three parts, with each part building on the other two to provide a fuller picture of Americans' conceptions regarding RBM and its relationship to PGM. In Part 1, I examined white, black and Hispanic Americans' beliefs and attitudes regarding RBM. Aim 1 examined whether there were racial differences in these beliefs and attitudes, and Aims 2 and 3 respectively examined whether genetic essentialist beliefs and racist attitudes helped explain potential racial differences in RBM beliefs and attitudes. The findings from Part 1 showed that the majority of white, black and Hispanic Americans did not believe RBM would be effective at the clinical level, but a majority of all three sampled groups would prefer to use RBM if it were available. The only racial difference that was found for RBM-related beliefs and attitudes measured in this study was that greater proportions of black and Hispanic respondents than white respondents believed RBM would be effective at reducing health inequalities.

Part 2 examined the effect of a vignette experiment involving different mock newspaper articles about the relationship between race and genes on RBM-related beliefs and attitudes. Part 2 built on the findings from Part 1 by examining the extent to which baseline-level conceptions regarding RBM might be affected by exposure to varying mass media messages about race and

genes. Aim 4 examined whether experimentally varying information about the degree of genetic similarity between races affects RBM beliefs and attitudes and Aim 5 examined whether acceptance of the information provided in the vignette was associated with differences in these beliefs and attitudes. The main finding from Part 2 was the racial difference in the vignette experiment's effect. The vignette experiment did not have an effect on white respondents' beliefs and attitudes regarding RBM, however, it did affect RBM-related beliefs and attitudes of black respondents such that mean endorsements of RBM's effectiveness and behavioral orientation towards using it were lower for black respondents assigned to the *race is genetic* or *admixture* vignettes than for black respondents assigned to the *social construction* vignette, *genetic health difference* vignette or no-vignette control condition.

Part 3 built on the findings of Parts 1 and 2 by examining how the American public's beliefs and attitudes regarding RBM compared to corresponding beliefs and attitudes regarding PGM. Aim 6 examined whether or not there are racial differences in beliefs and attitudes regarding PGM and Aim 7 examined how RBM beliefs and attitudes compared to those related to PGM. The findings from Part 3 showed that both white and black Americans generally held favorable beliefs and attitudes towards PGM, however, significantly greater proportions of whites believed PGM would be clinically effective and indicated a preference for using PGM compared to blacks in this study. Part 3's findings also showed that respondents generally favored PGM over RBM in terms of both clinical effectiveness and preferences for using either type of treatment, however for black respondents, exposure to either the *race is genetic* or *admixture* vignettes seemed to decrease the magnitude of difference in endorsement levels for PGM and RBM.

Collectively, the findings from this dissertation study both diverged from, and confirmed, findings from prior studies that examined racial and ethnic differences in RBM- and PGM-related beliefs and attitudes. The results of this dissertation study were discussed in detail in their respective individual study chapters. The following, therefore, is a discussion that highlights and integrates the major themes and key findings that emerged from this dissertation.

7.2 (Lack of) Racial Differences in Race-Based Medicine Conceptions

Part 1 showed that there was no significant difference between whites, blacks and Hispanics in their belief regarding RBM's individual-level effectiveness and preference for using RBM. All three groups examined in this study negatively appraised RBM's individual-level effectiveness at equal levels, but, generally equal proportions of all three groups also indicated a preference for using RBM. This lack of racial difference in beliefs and attitudes regarding RBM diverges from prior studies (Bevan et al., 2003; Condit et al., 2003; Marco, 2010) that examined similar RBM constructs. While the prior studies of racial and ethnic differences in RBM beliefs and attitudes conducted by Bevan and colleagues (2003), Condit and colleagues (2003) and Marco (2010) provided rich and valuable information related to the rationales behind Americans' beliefs and attitudes regarding RBM, they could not evaluate the prevalence of these beliefs and attitudes among the general population. By surveying a nationally representative sample of Americans, this study is the first to show that white, black and Hispanic Americans hold equally prevalent negative beliefs regarding RBM's clinical effectiveness, but also equally prevalent favorable attitudes towards using RBM.

The question of why white, black and Hispanic Americans do not differ in these two constructs deserves some attention, as most prior research on RBM conceptions indicated that blacks and Hispanics should be less likely than whites to endorse RBM's clinical effectiveness and less likely to prefer to use RBM. A simple explanation for the lack of difference could be that the black and Hispanic sub-samples were relatively small and larger samples perhaps would have detected racial differences.

One study conducted by Butrick and colleagues (2011) had a similar finding to this study of equally negative attitudes towards RBM among white and non-white study participants. They note that possible reasons behind the negative appraisal of RBM among the non-white respondents in their study relate to reasons identified in prior studies of RBM beliefs and attitudes, such as historical and contemporary racial discrimination and the belief that race is a poor proxy for underlying biology. They hypothesize that an awareness of these same reasons may also contribute to whites' negative attitudes towards RBM, but that an additional reason for their negative attitudes would be a possible lack of racial identity because they are part of the racial majority in the U.S. Butrick and colleagues argue that if one is not distinctly aware of his or her identity as being part of a racial group, then RBM may seem irrelevant as well. This theory that they put forth could explain the lack of racial differences in these RBM belief and attitudinal measures.

If sample size was not a meaningful limitation to the external generalizability of this dissertation study, then it seems that white and black Americans indeed hold similar beliefs about and attitudes towards RBM. One implication of this finding is that industry-based RBM proponents may find a generally receptive patient population for the delivery of RBM regardless

of the race or ethnicity of patients. Despite there being, on average, negative beliefs about the clinical effectiveness of RBM, there were also uniformly high preference indications for using RBM. However, it is possible that armed with more information, particularly information regarding the potential clinical, ethical and social costs and benefits associated with RBM, whites and blacks would begin to diverge in their beliefs and attitudes. This seemed to be the case based on the results of Part 2's *race vignette experiment's* effect on RBM beliefs and attitudes. Although the sample only included white and black respondents and none of the vignettes specifically discussed RBM, the results indicated that while whites' beliefs and attitudes regarding RBM were not affected by the different types of mock news articles discussing varied relationships between race and genes, blacks more negatively appraised RBM's individual-level effectiveness and indicated lowered preference levels for using RBM if they were exposed to the *race is genetic* vignette or the *admixture* vignette.

Ultimately, RBM proponents' concerns about non-white populations' receptiveness to using RBM may be unwarranted. Meanwhile, RBM opponents may need to implement interventions to better communicate concerns associated with RBM if one of their goals is to garner lay support for rejecting efforts to develop and promote RBM in the U.S.

7.3 Discordance between Effectiveness Beliefs and Behavioral Orientation

For both RBM and PGM, the results showed that substantially greater proportions of respondents indicated a preference for using RBM or PGM compared to the proportions who respectively endorsed RBM's or PGM's individual-level effectiveness. These results were somewhat surprising since one would expect that if an individual believes a form of treatment is

ineffective, then that person would *not* prefer to use the treatment. However, the substantial numbers of respondents who indicated a preference for using RBM or PGM, even if they didn't believe one form of treatment or the other was effective, could reflect a desire to try treatments with potentially significant benefits, even if one's initial instinct is to believe such treatments do not work.

Regarding RBM specifically, it is possible that some of the respondents, based on things that they have heard or learned over the years, have been socialized to believe that RBM is ineffective or otherwise "bad", but when it comes down to making a concrete decision that they think would benefit them, they do not apply this acquired belief to their behaviors. The inconsistency between RBM beliefs and behavioral orientation was seen in a previous U.S.-based study that found the majority of its respondents to be "suspicious" about RBM, but with a portion noting they would still use it if it was available (Bevan et al., 2003; Lynch & Dubriwny, 2006). Lynch and Dubriwny (2006) explain this inconsistency through their "double bind" theory that some individuals, in particular racial and ethnic minorities, dispute a genetic basis for race, however, their racial/ethnic identification places them in a double bind between choosing to use RBM — which implies what they are disputing — or forgoing use of RBM, which could be perceived as denying their racial identity. Racial or ethnic identification is a way for individuals to find common cause and to be socialized into the associated group's culture (Lynch & Dubriwny, 2006). Studies have shown that blacks have a greater degree of racial identification than whites, which can explain why actions that could be perceived as denying one's racial identity are often discouraged (Allen, Howard, & Grimes, 1997; Coard, Breland, & Raskin, 2001). Therefore, although choosing to use or not use RBM each comes with perceived negative

consequences for some people, ultimately, some will still choose using RBM as the lesser of two "evils".

The inconsistency between effectiveness belief and behavior may also result from some respondents believing RBM and/or PGM are attractive ideas, but seemingly abstract. Therefore, while individuals may find it difficult to assess the effectiveness of either form of treatment, they are open to using one or the other if the clinical tools and treatments were available. The discordant findings between RBM and PGM individual-level effectiveness beliefs and behavioral orientation are important findings for which drug makers and providers should take note. Despite some negative public opinions towards RBM specifically, this finding suggests that there is an incentive for drug makers to continue to develop and market RBM since there seems to be a potentially large market of consumers who would be willing to use RBM. Regarding PGM, even though there is a portion of the American public – particularly among blacks Americans – who do not believe PGM would be effective at the individual level, nearly all of the white respondents and a majority of the black respondents surveyed in this study indicated a preference for using PGM if it were available.

These findings clearly indicate that regardless of Americans' beliefs in the clinical effectiveness of treatments, there is a willingness to try new types of medical treatments, even when the treatments may be considered controversial and are associated with serious ethical, social, and/or scientific concerns. The pharmaceutical industry and other stakeholders who support and/or have something to gain from the development and implementation of RBM or PGM can take solace in the fact that even if the lay American public holds concerns regarding these new and, at least in the case of RBM, controversial forms of treatment, these concerns may

not be the true barriers to treatment adherence. Health care providers, researchers and other stakeholders who are concerned about the social, ethical, scientific and medical implications of such treatments, may need to focus their interventions on addressing these concerns at levels that are in addition to the patient level, such as government agencies (e.g., NIH, FDA), the pharmaceutical industry, and medical providers.

7.4 Mass Media Effects on Race-Based Medicine Beliefs and Attitudes

The findings from Part 2 showed that exposure to messages about race and genetics can differentially affect beliefs and attitudes regarding RBM depending on the race of individuals. A single exposure to different mock news articles about the relationship between race and genetics had no effect on white respondents' beliefs and attitudes regarding RBM, however, it had an unexpected effect on black respondents' beliefs and attitudes regarding RBM. The *admixture* vignette, which, depending on how the concept of admixture is interpreted, may suggest to some that there's a genetic basis to race, and the *race is genetic* vignette, which explicitly states that there is a genetic basis to race, both seemed to lower belief in RBM's individual-level effectiveness, preferences for using RBM and belief in its ability to improve health inequalities among the black respondents compared to the *social construction, genetic health difference* and no-vignette control conditions. This result was surprising in light of the results from related studies using the *race vignette experiment* that showed that these two vignettes were associated with relatively higher mean belief in essential racial differences among the black (and white) study participants, compared to mean belief in essential racial differences for those assigned to the *social construction* vignette (Phelan, Link and Feldman, 2013; Phelan, Link, Johnson and

Yang, under review). Because RBM implies that there is some genetic, or at least underlying biological, basis to race, I had proposed that exposure to information suggesting or stating that there is a genetic basis to race would increase beliefs in RBM's individual-level effectiveness and preferences for using RBM. However, the results show that a single exposure to vignettes with these messages on average had the opposite effect on black study respondents, and no effect on white respondents. Why this is the case deserves some attention.

Regarding the white respondents, it is possible that there was a disconnect between the idea that there is a genetic basis to the race concept and reasons for why race-specific prescribing might be clinically effective. A lack of familiarity and consideration of why diagnostic tools and treatments may be differentially effective between different racial groups perhaps led the white study respondents to believe that RBM could be effective for reasons other than genetic differences, such as health behavior differences or differences in environmental exposures that could affect treatment effectiveness. It is also possible that a single exposure to the assigned vignette condition was not enough to influence white respondents' RBM beliefs and attitudes. Prior studies have shown that messages are more likely to be processed and interpreted if they come from multiple sources, indicating that a single exposure may not be enough (Harkins & Petty, 1981, 1987). Although Phelan and colleagues' studies showed that a single exposure to the vignettes in this experiment was enough to influence belief in essential racial differences, because none of the vignettes were directly related to the concept of RBM, it is possible that additional exposure to a vignette's message, or media messages specifically about RBM, are required in order to have some type of effect on white Americans' RBM beliefs and attitudes.

It is also unclear as to why black respondents assigned to the *race is genetic* and *admixture* vignettes on average had more negative appraisals of RBM compared to black respondents assigned to the other vignette conditions. Lower endorsement of these measures can possibly be explained as negative responses to these vignettes' messages as a means to reject the idea that there is a genetic basis to racial differences. However, Part 2's vignette acceptance measure indicated that on average, black respondents accepted these vignettes' messages, and, as previously noted, both messages increased belief in essential racial differences.

Specifically regarding the *admixture* vignette, it is possible that the vignette's message that most Americans are of mixed race may have led black respondents to believe that RBM could not be effective because it assumes that people can be easily categorized into distinct racial groups. At the same time, the vignette's message may simultaneously be reinforcing the idea that there is a genetic basis to race, as evidenced by the findings of the related study by Phelan et al. (under review). If that is the case, that could plausibly explain the reason for why black respondents assigned to the *admixture* vignette condition in this study had more negative appraisals of RBM while also indicating greater belief is essential racial differences in Phelan et al.'s (under review) study.

One implication of the finding that the *race is genetic* and *admixture* vignettes could lower black respondents' endorsement of the three RBM dependent variables is that how the relationship between race and genes is discussed in the news has the potential to affect RBM-specific beliefs and attitudes among the black population in the U.S. Notably, the two related studies by Phelan and colleagues respectively showed that the number of articles about race and genetics significantly increased over the period during and following the completion of the

Human Genome Project (HGP), and that a substantial portion of these articles were about direct-to-consumer ancestry tests/admixture testing. In addition to Phelan et al.'s (2013) finding that articles about race and genetics have been on the rise during the past two to three decades, there is also evidence to suggest that messages similar to the *race is genetic* vignette had specifically been on the rise during and following the completion of the HGP. Condit and Lynch's (2006) content analysis of articles about race and genes showed that there was a rise in articles that were slanted towards the position that there is a genetic basis to racial categories in the years during and following the completion of the HGP.

The increase in news stories presenting messages similar to those presented in the *race is genetic* and *admixture* vignettes suggests that the American public has been increasingly exposed to news stories that have the potential to decrease belief in RBM's effectiveness and preferences for using RBM among non-Hispanic black Americans specifically. If the intent behind developing and integrating RBM into the practice of medicine is to improve race-specific health inequalities, which is an argument that is meant to particularly resonate among racial and ethnic minorities who carry the burden of poorer health outcomes, then RBM supporters would need to take note that black Americans may be less receptive towards using RBM depending on the extent to which they are exposed to mass media messages about race and genetics that are similar to those presented in the *race is genetic* and *admixture* vignettes.

The results examining the *race vignette experiment's* effects on RBM-related beliefs and attitudes suggest that while white and black Americans may not significantly differ in their beliefs about RBM's individual-level effectiveness or behavioral orientation (as indicated by the results in Chapter 4), mass media coverage of the relationship between race and genes may

differentially affect these beliefs and attitudes depending on the self-identified race or ethnicity of individuals.

7.5 Race-Based Medicine and the Health Disparities Debate

The findings from Part 1 showed that there were racial differences in the belief that RBM would be effective at reducing health inequalities. I had hypothesized that whites would be more likely to believe that RBM would be effective at reducing health inequalities based on prior studies indicating that white Americans had more favorable appraisals of RBM's clinical effectiveness than black, Hispanic and other racial and ethnic minority populations. The results, however, showed the opposite to be true – blacks and Hispanics indicated a significantly greater belief in RBM's ability to reduce health inequalities than whites in this study.

In the ongoing debate over how to address growing health inequalities between minority and non-minority populations, this is an important finding that should be considered within the larger debate. Past research has shown that blacks, Hispanics and other racial and ethnic minorities are more likely to believe that these populations are medically underserved compared to non-Hispanic white Americans (Lillie-Blanton et al., 2000). If this has continued to be the case, it is possible that blacks and Hispanics are generally of the belief that any intervention meant to improve the health of racial and ethnic minorities, even controversial ones such as RBM, is better than the current state of affairs.

In this debate over identifying and implementing effective strategies to reduce health inequalities, public opinion from the populations that are disproportionately burdened with

poorer health statuses and outcomes needs to be assessed in order to garner public support for identified strategies. If a majority of racial and ethnic minority populations are likely to believe that RBM could reduce health inequalities, then it is quite possible that they would be as likely – or more likely – than whites to support RBM as a tactic to reduce health inequalities.

It should be noted that RBM has had a limited presence in the delivery of healthcare services, and although RBM knowledge levels were not assessed in this study, it would be reasonable to assume that the majority of the lay public is unfamiliar with the concept of RBM. Should the healthcare and pharmaceutical industry decide to promote RBM as a strategy for addressing racial and ethnic health inequalities, there will likely be efforts on both sides of the debate to better educate the public about RBM. Depending on which side of the debate is more effective at communicating its RBM-related messages, these efforts could influence in different directions beliefs about RBM's effectiveness at the individual and population levels and behavioral orientations towards using RBM.

7.6 Personalized Genomic Medicine and the Health Disparities Debate

In the context of the larger debate regarding causes of, and solutions to address, racial health disparities in the U.S. and globally, the finding that whites are more likely than blacks to endorse the effectiveness of PGM and indicate a preference to use PGM, has several implications. First, the medical community and other relevant stakeholders who support a paradigm shift towards PGM as the standard of clinical medicine may face challenges in encouraging black Americans, and possibly other racial and ethnic minority populations, to use PGM. Part 3 found that nearly half of the black respondents did not believe PGM would be

effective, and approximately 1 out of every 4 said they would not prefer to use PGM. While the benefits of personalizing medical care based on genomic profiles may seem obvious to health care providers, they may not be particularly evident to the lay public. Prior studies of blacks' and other minority populations' conceptions regarding PGM and genetic testing indicated concerns such as cost, discrimination, and mistrust in medical authority (Hipps et al, 2003; Thompson et al., 2003). These same concerns, however, have been expressed by blacks regarding health care more broadly (Lillie-Blanton et al., 2000; Robert & Booske, 2011). The similarity in black Americans' concerns regarding PGM specifically and health care in general suggests that a paradigm shift towards PGM as the standard of medical care may have minimal benefits towards improving health inequalities if there are not concurrent efforts to address the larger concerns that minority populations continue to face, including communicating these efforts with racial and ethnic minority populations.

In the context of efforts to improve racial and ethnic health inequalities, these findings provide insight in to some of the challenges that health care providers and other stakeholders may face even as new treatments and biomedical technologies are introduced to improve the delivery of medicine to racially, ethnically, and genomically diverse populations. If PGM is indeed the future of medicine, then it is worthwhile to better understand the race-specific differences between blacks and whites that lead to nearly half of black Americans not believing PGM would be effective at the individual level and one quarter not wanting to use PGM. Focusing on the improvement of diagnostic tools and treatments, while important as far as advancing the quality of care potentially available to the public, may be moot for those who cannot access care because of any number of financial, social, cultural, linguistic, geographic or other barriers that racial and ethnic minorities face in the U.S. today. Future research may be

warranted to better understand the reasons for why a substantial portion of black Americans may not believe PGM would be effective and would not prefer to use PGM.

7.7 Americans Prefer Personalized Genomic Medicine over Race-Based Medicine

The results from Part 3 of this dissertation clearly show that white and black Americans prefer PGM over RBM. This finding is not surprising. A plausible explanation for this difference is that a sizable portion of respondents are hesitant to endorse the idea that effective treatments can be developed for different racial groups, considering the fact that the idea of a biological or genetic basis to race remains highly controversial. Meanwhile, many may infer that treatments personalized to individuals' genomic profiles are more likely to be effective than treatments designed for much broader populations of people, however such populations are defined. A combination of these two beliefs may subsequently have led to greater endorsement of PGM over RBM beliefs and attitudes. These findings confirm those of prior studies that indicated a substantial preference for PGM over RBM (Bevan et al., 2003; Butrick et al., 2011). As previously noted, although both whites and blacks held more favorable beliefs and attitudes towards PGM compared to RBM, blacks' endorsement of PGM was more tempered than that of whites. Proponents of PGM, therefore, should consider moving cautiously towards implementing PGM with Americans, particularly black Americans who reportedly have noted several concerns regarding PGM or genetic testing in general (Hipps, 2003; Schulz, Caldwell & Foster, 2003; Singer, Antonucci & Van Hoewyk, 2004; Thompson et al., 2003).

7.8 Strengths and Limitations of the Study

This dissertation was the first nationally representative study of Americans' beliefs and attitudes regarding RBM and PGM. However, the study was not without its limitations. Although I was involved with the design and implementation of this study as a graduate research assistant working with Professor Phelan as the Principal Investigator, the Genetics & Stigma Study had research aims and hypotheses that were separate and apart from those that I developed for this dissertation study. Therefore, the primary purpose behind the design of the survey and vignette experiment was to meet the research aims of the Genetics & Stigma Study. I was fortunate to have the opportunity to insert items for measures that I had developed with assistance and support from the research study's team, however, there was a limit to the number of items that I could include in the survey. Consequently, items such as measures of RBM and PGM knowledge levels, which would have been useful covariate measures to control for in the linear regression models, and additional items to measure RBM and PGM behavioral orientation and RBM population-level effectiveness, could not be included in the survey. Despite the lack of knowledge level measures, the concepts of RBM and PGM were briefly explained to all respondents prior to the section that included these items. Furthermore, the way the items are worded, the concepts are explained rather than simply referenced (e.g., "If there were different drugs for people of different racial groups, I would want to use the race-specific drug."). Therefore, it is possible that differences in familiarity with the concepts of RBM and/or PGM did not have strong effects on beliefs and attitudes related to these concepts because all respondents were briefed on the concepts prior to answering the items.

In addition, it would have been interesting to examine the effect of an RBM-specific vignette in the *race vignette experiment* on RBM-related beliefs and attitudes for comparison with the effects of the other vignettes, however, the limited sample size and needs of the Genetics & Stigma Study meant this was not possible to do.

A final limitation was the small number of black and Hispanic respondents who participated in the study. Despite a two-tiered sampling framework that included an oversample of households from telephone exchanges in neighborhoods believed to be more densely populated with black and Hispanic families, the sample sizes for these two groups still ended up being relatively small for my analytical needs. Consequently, I did not have the statistical power needed in some of the analyses to detect potential differences between racial and ethnic groups, even for large effect sizes.

Despite these limitations, there were a number of strengths to this study that must be noted. This dissertation study is the first nationally representative study of RBM- and PGM-related beliefs and attitudes, providing findings with good external generalizability to the greater-U.S. population of white, black and Hispanic Americans. Prior studies were mostly exploratory and limited to certain geographic regions of the U.S. The findings from this study are the first to quantitatively measure beliefs and attitudes regarding RBM and PGM among white, black and Hispanic individuals residing across the U.S. Notably, some of the findings regarding racial differences in RBM beliefs and attitudes – or more precisely, a lack there of – diverge from prior exploratory studies examining racial differences and similarities regarding RBM beliefs and attitudes. These findings therefore provide a new perspective on the lay public's conceptions regarding RBM.

This study is also the first to experimentally measure the effects of varying information about the relationship between race and genes on RBM-related beliefs and attitudes. Because RBM is a fairly new concept of which most of the mainstream public may have little to no awareness, it is likely that one of the primary sources of information about or relating to RBM will come from mass media. Therefore, experimentally measuring the effects of mock news articles about race and genes on the lay public's conceptions regarding RBM provides important insight into how different segments of the public may change their RBM-related beliefs and attitudes as they are exposed to various types of information on concepts related to RBM.

Another strength of this study was the development of new measures to evaluate the lay public's beliefs and attitudes regarding RBM and PGM. These measures were developed based on themes that emerged from the relevant literature and were refined in consultation with the members of the Genetics & Stigma Study research team, many of whom were familiar with the academic literature on RBM specifically, and race and genes more generally, in addition to mass media representations of both concepts. This aided the validity of the measures for this study. The reliability analyses for all of the measures were also adequate to very good for the sample as a whole and by race. Prior studies (Bevan et al., 2003; Butrick et al., 2011; Condit et al., 2003; Marco, 2010) had measured RBM individual-level effectiveness and behavioral orientation beliefs and attitudes, but this was the first study to measures beliefs about RBM's effectiveness at addressing health inequalities in the U.S. Because RBM has been promoted by a number of scholars, scientists and segments of the pharmaceutical industry as a solution to the persistent problem of racial and ethnic health disparities, information on the extent to which the lay public believes this would be possible should be of interest to various stakeholders in the debates surrounding the development of RBM and potential solutions for addressing health disparities.

Finally, other strengths of this study relate to its research design. The anonymity of participating in an internet-based study that asks questions about sensitive topics like race reduces the potential for social desirability bias, which is more likely to occur in in-person or telephone surveys. There is also a convenience factor for internet-based surveys. Respondents can log on to initiate and complete their surveys at times that are convenient for them (provided that it is done within the designated data collection time period). This is more difficult to do with telephone and in-person survey research studies. The convenience of the internet-based survey format for this study likely increased the overall response rate compared to potential response rates had the survey been administered by telephone or in-person.

7.9 Directions for Future Research

I believe this dissertation study provides significant insight into the lay American public's conceptions regarding RBM and its relationship to PGM. However, some of the findings point to the need for future research. Despite the lack of racial differences in RBM individual-level effectiveness belief and behavioral orientation, exposure to the *race survey vignette* experiment indicated that differences in these beliefs and attitudes began to emerge between white and black respondents. Although none of the vignettes directly discussed RBM, exposure to the *race is genetic* or *admixture* vignettes seemed to lower black respondents' belief in RBM's effectiveness at the clinical level and their preferences for using RBM compared to exposure to one of the other vignettes or assignment to the no-vignette condition. This was not the case for the white respondents in this study. Because exposure to only tangentially-related topics in the vignette experiment seemed to be enough to influence black respondents' beliefs and attitudes regarding

RBM, future research should be considered to examine the effect of exposure to mass media stories that specifically discuss RBM on RBM-related beliefs and attitudes. In particular, it would be interesting to examine the effect of varying discussion on the social, ethical and scientific issues surrounding RBM on RBM beliefs and attitudes. Caulfield and Harry (2008) showed that there were a substantial number of news articles about BiDil in 2007 that provided a variety of perspectives on the topic, including varying levels of discussion regarding the scientific, social and ethical controversies surrounding the drug. This one study provides evidence of not only the prevalence of news stories on RBM in recent years but the variety of ways in which the topic is discussed in the news. An examination of the influence of similar news stories on RBM beliefs and attitudes would enable us to better understand the effects of mass media on RBM-related conceptions.

It is also possible that a single exposure to the vignettes in the *race survey experiment* was not enough to influence RBM-related beliefs and attitudes. Perhaps, greater differences in RBM-related beliefs and attitudes would have emerged depending on the race of respondents and/or type of vignette received from an experiment that involved multiple exposures to the same vignette message over time. Future research may therefore want to examine the effect of multiple exposures to a vignette's message over time on RBM-related beliefs and attitudes.

Future studies may also want to assess the possible reasons for why respondents endorsed RBM's and PGM's effectiveness and behavioral orientation towards using either form of treatment. Although assessing the extent to which respondents endorsed these beliefs and behaviors is an important step towards better understanding the American public's beliefs and

attitudes regarding race-targeted and personalized pharmacogenomic medicine, better understanding the reasons behind these beliefs and attitudes is needed as well.

7.10 Conclusion

The HGP's mapping of the human genome has significantly advanced not only our knowledge of human beings' genetic make-up, but also applications of that knowledge in meaningful ways, most notably, medical advances in the field of pharmacogenomics. However, promises of a medical system based on PGM have been slow to develop. Consequently, RBM has been touted as an acceptable interim alternative to PGM, where medicine is tailored based on supposed biological or genetic similarities in populations rather than on the genomic profiles of individuals. Because the concept of race and the extent to which there is or is not a genetic basis to the concept are controversial and contested, RBM has also been controversial, attracting both opponents and proponents of its development and implementation. Without question, race has held, and continues to hold, a prominent place in American history and society. Racial differences, historically and currently, exist in not only socio-economic and health outcomes, but also in beliefs and attitudes regarding a host of policy issues related to these differences in outcomes (Hunt, 2007; Lillie-Blanton et al., 2000; Robert and Booske 2011). Because RBM implies that there is some genetic, or at least biological, basis to race, it is natural to predict that there would be racial differences in beliefs regarding RBM's effectiveness and intentions to use RBM, in part because prior research has shown racial differences in how race is conceptualized (Dubriwny, Bates & Bevan, 2004; Jayaratne et al., 2009; Sheldon, Jayaratne, Feldbaum et al., 2007; Sheldon, Jayaratne & Petty, 2007). Therefore, assessing the American public's beliefs and

attitudes regarding RBM, particularly those of racially and ethnically diverse Americans, enables both proponents and opponents of RBM to better understand the extent to which Americans would use RBM and believe in its effectiveness, and then plan accordingly.

I believe the data from this dissertation study greatly expands our understanding of RBM and PGM beliefs and attitudes, racial and ethnic differences and similarities in these beliefs and attitudes, and media influences on RBM-specific beliefs and attitudes. As the first nationally representative study of Americans' RBM- and PGM-related beliefs and attitudes, this study provides insight into Americans' conceptions of RBM and PGM that could not be captured from previously conducted exploratory studies. Key findings such as preferences for using RBM or PGM exceeding belief in either form of treatment's individual-level effectiveness, and more favorable appraisals for PGM compared to RBM, confirmed prior qualitative studies of these topics. However, the finding that whites, blacks and Hispanics do not significantly differ in their belief in RBM's individual-level effectiveness or preferences for using RBM, diverge from prior exploratory studies that suggested that black, Hispanic and other racial and ethnic minorities were less likely to believe in RBM's clinical effectiveness or be willing to use RBM than whites. These new findings are important to the extent that they not only suggest that whites are as likely as blacks and Hispanics to question race-targeted treatments, but also that there may be less opposition from racial and ethnic minority Americans to using race-targeted treatments than previously thought.

The data also showed that a single exposure to different mock news articles about the relationship between race and genes was associated with racial differences in RBM-related beliefs and attitudes, suggesting that mass media can have differential effects on white versus

black Americans' RBM conceptions. If RBM continues to be developed and integrated into the practice of medicine, it is likely that there will be diverse media coverage of this topic. Depending on the extent to which different racial and ethnic populations are exposed to mass media coverage of RBM or race and genetics, as well as how these topics are presented in mass media messages, we may in fact see racial differences begin to emerge in beliefs and attitudes regarding RBM. This study was only able to evaluate the effect of mock news articles on relationships between race and genes that were not RBM-specific. As noted previously, in order to truly get a sense of the extent to which Americans would believe RBM is effective and would in fact use RBM, then future research should consider an examination of RBM beliefs and attitudes following exposure to information specifically about RBM, including variations in coverage of some of the ethical, social and scientific issues associated with RBM.

These findings should also be considered in the context of the larger debate regarding causes of and solutions to health disparities. Proponents of RBM as an interim form of PGM view these two types of treatments as key solutions to addressing race-specific health inequalities (Burchard et al., 2003; Nguyen et al., 2007; Risch et al., 2002). The results from this dissertation study suggest that despite beliefs from the majority of sampled respondents that RBM is not clinically effective, the majority were, in fact, open to using RBM. To the extent that race- and ethnicity-targeted diagnostic tools and treatments can be clinically effective, particularly for health conditions and diseases for which racial and ethnic minority populations have traditionally experienced poorer outcomes, then an openness to using RBM regardless of the patient's race or ethnicity means that RBM does have the potential to provide great benefits. Notably, however, even if RBM can improve the quality of diagnostic tools and treatments available for traditionally under-served populations, it does not address the numerous other well-established

economic, social and cultural barriers to care that racial and ethnic minority populations continue to face. As such, even if RBM is integrated into the practice of medicine, its effectiveness at addressing health inequalities may be limited.

Finally, the social cost of RBM's potential to re-inscribe biological and genetic conceptions of race should not be ignored. Phelan, Link and Feldman (2013) in a related study showed that a single exposure to the *genetic health difference* vignette was associated with a higher belief in essential racial differences than exposure to the *social construction* vignette or assignment to the no-vignette condition. In fact, this level of essential racial differences belief was as high as that following exposure to the *race is genetic* vignette. Although not examined in this study, the findings from Phelan and colleagues suggest that exposure to positive mass media messages about RBM, or more salient, public awareness that RBM exists and has been integrated into the practice of medicine, have the potential to increase belief in essential racial differences because RBM implies that there is some biological or genetic difference between racial groups. To the extent that such a belief, in turn, could lead to an increase in prejudicial attitudes or discrimination against racial and ethnic minority populations is a grave concern that leads us back to the question of whether RBM is a necessary path that medical research and development should follow, particularly when there are other known barriers to the receipt of quality, effective health care that have not been adequately addressed.

This dissertation study attempted to provide a fuller picture of the extent to which Americans believe in the effectiveness of RBM and PGM, whether they would be open to using either, and whether mass media has the potential to influence changes in these beliefs and attitudes specifically with respect to RBM. As pharmacogenomic research moves forward, there

is the hope that clinical tools and treatments can be developed to personalize treatments for individuals based on their unique genomic profiles as well as other factors that contribute to the health, wellness, diseases susceptibility and effectiveness of treatments for diverse individuals. However, PGM has been slow to progress and RBM has been promoted as an acceptable alternative to conventional forms of treatment that have at times been met with varying levels of success for different racial and ethnic populations. Better understanding of the public's beliefs and attitudes regarding these two emerging forms of clinical care will enable stakeholders to identify the extent to which the public supports RBM and PGM and what challenges may lie ahead. As the first nationally representative study of Americans' conceptions regarding RBM and PGM, this study will hopefully inspire stakeholders in the debate surrounding RBM to better consider the diversity of beliefs and attitudes regarding RBM in their decisions to continue its development and promotion.

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Appendix A:

HEALTH VIGNETTE EXPERIMENT SURVEY

First we have some questions about your opinion of the article.

I1. In your opinion, did the article give an accurate description of the causes of ["major depressive disorder"/"coronary artery disease"/"obesity"]?

The article strongly overemphasized [1] as a cause of [2]. 5
The article somewhat overemphasized [1] as a cause of [2] 4
The article put the right amount of emphasis on [1] as a cause of [2] 3
The article somewhat underemphasized [1] as a cause of [2] 2
The article strongly underemphasized [1] as a cause of [2] 1

[1 = "stress and pressure in the environment"/ "a person's own decisions and actions"/ "genetic factors"]
[2 = "major depressive disorder"/ "coronary artery disease"/ "obesity"]

I2. The article struck you as biased and inaccurate.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

Next we have some more general questions about ["major depressive disorder."/"coronary artery disease."/"obesity."] Remember, there are no right or wrong answers. We are only interested in what you think.

I3. Of the following factors, which do you personally think is the most important cause of ["major depressive disorder"/"coronary artery disease"/"obesity"]?

Genetic factors 1
A person's own decisions and actions 2
Factors in a person's social environment 3

I4. Of the following factors, which do you personally think is the most important in determining a person's general level of health?

Genetic factors.....1
A person's own decisions and actions.....2
Factors in a person's social environment 3

I5. Of the following factors, which do you personally think is the most important in determining a person's level of intelligence?

Genetic factors.....1
A person's own decisions and actions.....2
Factors in a person's social environment 3

I6. Of the following factors, which do you personally think is the most important in determining how successful a person is in life?

Genetic factors.....1
A person's own decisions and actions.....2
Factors in a person's social environment 3

I7. In your opinion, how likely is it that a child of a person with ["major depressive disorder"/"coronary artery disease"/"obesity"] would develop the same condition?

Very likely.....4
Somewhat likely.....3
Somewhat unlikely.....2
Very unlikely.....1

I8. In your opinion, how strongly does ["major depressive disorder"/"coronary artery disease"/"obesity"] run in families?

Very strongly.....4
Somewhat strongly.....3
Not very strongly.....2
Does not run in families at all.....1

I9. ["Major depressive disorder"/"Coronary artery disease"/"Obesity"] can be treated effectively.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I10. ["Major depressive disorder"/"Coronary artery disease"/"Obesity"] is likely to go away on its own, even without treatment.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I11. It is unlikely that a person with ["major depressive disorder"/"coronary artery disease"/"obesity"] will ever be completely free of this condition.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I12. Even if a person has been free of ["major depressive disorder"/"coronary artery disease"/"obesity"] for years, the condition might return at any time.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I13. Even if ["the symptoms of major depressive disorder are controlled"/ "the symptoms of coronary artery disease are controlled"/ "an obese person's weight is controlled"], the person will always remain vulnerable to this condition.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I14. A person can be permanently cured of [“major depressive disorder”/“coronary artery disease”/“obesity”].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I15. A person who has [“had major depressive disorder”/“had coronary artery disease”/“been obese”] needs to [“be treated for”/“maintain careful control of their weight”] their whole life, or the condition may return.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I16. Even if a person’s [“symptoms of major depressive disorder are eliminated”/“symptoms of coronary artery disease are eliminated”/“obesity is kept under control”], the underlying condition will always remain within the person.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I17. How serious do you consider [“major depressive disorder”/“coronary artery disease”/“obesity”] to be?

Extremely serious.....4
Very serious 3
Moderately serious.....2
Not very serious 1

I18. How upset would you be if a loved one [“developed major depressive disorder”/“developed coronary artery disease”/“became obese”]?

Extremely upset 4
Very upset 3
Moderately upset.....2
Not very upset.....1

I19. A person ["with major depressive disorder"/"with coronary artery disease"/"who is obese"] can overcome this condition if they take the right actions.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I20. When you think of a person who ["has major depressive disorder"/"has coronary artery disease"/"is obese"], how different do you think they are from other people?

Very different 4
Somewhat different 3
Not very different 2
Not different at all 1

I21. Although a person ["with major depressive disorder"/"with coronary artery disease"/"who is obese"] may seem just like everyone else, they are actually different in important ways.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I22. Someone with arthritis or a broken leg has just one thing wrong with them, but a person who ["has major depressive disorder"/ "has coronary artery disease"/"is obese"] is very different from other people.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I23. Although they may be like other people in many ways, there is something about people ["with major depressive disorder"/"with coronary artery disease"/"who are obese"] that is fundamentally different from other people.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

When you think of people [“with major depressive disorder”/“with coronary artery disease”/“who are obese”], you feel:

	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree

I24. Disgusted by them
I25. Sympathy for them
I26. Pity toward them
I27. Anger toward them
I28. Annoyed with them

I29. A person [“with major depressive disorder”/“with coronary artery disease”/“who are obese”] has no one to blame but themselves.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I30. A person [“with major depressive disorder”/“with coronary artery disease”/“who are obese”] probably did something to cause this condition.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I31. It is a person’s own fault if they [“develop major depressive disorder”/“develop coronary artery disease”/“become obese”].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I32. I can understand why a person ["with major depressive disorder"/"with coronary artery disease"/"who is obese"] would feel embarrassed about having this condition.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I33. If a person ["has major depressive disorder"/"has coronary artery disease"/"is obese"], how responsible are the parents for causing the condition?

Very responsible 4
Somewhat responsible 3
Not very responsible 2
Not responsible at all 1

I34. It is largely the fault of the parents if a person ["develops major depressive disorder"/"develops coronary artery disease"/"becomes obese"].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

Listed below are several pairs of words. For each pair, please select a point on the grid that best describes how you think about people ["with major depressive disorder"/"with coronary artery disease"/"who are obese"].

1	2	3	4	5	6	7

I35. LAZY ___ ___ ___ ___ ___ ___ ___ INDUSTRIOUS

I36. GOOD SELF-CONTROL ___ ___ ___ ___ ___ ___ ___ POOR SELF-CONTROL

I37. WEAK ___ ___ ___ ___ ___ ___ ___ STRONG

I38. COMPETENT ___ ___ ___ ___ ___ ___ ___ INCOMPETENT

I39. DANGEROUS ___ ___ ___ ___ ___ ___ ___ SAFE

I40. GOOD ___ ___ ___ ___ ___ ___ ___ BAD

I41. UNPLEASANT ___ ___ ___ ___ ___ ___ ___ PLEASANT

I42. POWERFUL ___ ___ ___ ___ ___ ___ ___ POWERLESS

I43. SICKLY ___ ___ ___ ___ ___ ___ ___ HEALTHY

I44. LIKABLE ___ ___ ___ ___ ___ ___ ___ UNLIKABLE

I45. DISREPUTABLE___ ___ ___ ___ ___ ___ ___ REPUTABLE

I46. NORMAL ___ ___ ___ ___ ___ ___ ___ ABNORMAL

I47. People would look down on you if you married someone ["with major depressive disorder"/"with coronary artery disease"/"who is obese"].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I48. Your status in the eyes of others would be lowered if your main romantic involvement in life were with someone ["with major depressive disorder"/ "with coronary artery disease"/"who is obese"].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I49. People would make fun of you if most of your friends [“had major depressive disorder”/ “had coronary artery disease”/“were obese”].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I50. [“Major depressive disorder”/“Coronary artery disease”/“Obesity”] is a medical condition.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I51. A person with [“major depressive disorder”/“coronary artery disease”/“obesity”] should seek professional help for this condition.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I52. A person with [“major depressive disorder”/“coronary artery disease”/“obesity”] should take prescription medications for this condition.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I53. A person with [“major depressive disorder”/“coronary artery disease”/“obesity”] should take steps to control the condition.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I54. Please indicate whether you would like to see more or less government spending for the prevention and treatment of [“major depressive disorder”/“coronary artery disease”/“obesity”]. Remember that if you say “much more,” it might require a tax increase to pay for it.

Spend much more 5
Spend more 4
Spend the same as now 3
Spend less.....2
Spend much less.....1

I55. How willing would you personally be to pay $300 more a year in taxes to find a way to prevent [“major depressive disorder”/“coronary artery disease”/“obesity”]?

Definitely willing.....4
Probably willing.....3
Probably not willing.....2
Definitely not willing.....1

I56. On the whole, do you think it should or should not be the government’s responsibility to provide health care for persons [“with major depressive disorder”/ “with coronary artery disease”/“who are obese”]?

Definitely should be.....4
Probably should be.....3
Probably should not be.....2
Definitely should not be.....1

I57. On the whole, do you think it should or should not be the government’s responsibility to provide disability benefits for persons [“with major depressive disorder”/ “with coronary artery disease”/“who are obese”]?

Definitely should be.....4
Probably should be.....3
Probably should not be.....2
Definitely should not be.....1

I58. A person [“with major depressive disorder”/ “with coronary artery disease”/“who is obese”] should have to pay extra for their health insurance.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I59. Employers should be allowed to deny people [“with major depressive disorder”/ “with coronary artery disease”/“who are obese”] a job because of their condition.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I60. If someone [“with major depressive disorder”/ “with coronary artery disease”/“who is obese”] needs a kidney transplant, they should be given a lower priority on the waiting list than someone [“without major depressive disorder”/“without coronary artery disease”/ “who is not obese”].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I61. [“A person with major depressive disorder”/“A person with coronary artery disease”/“An obese person”] should be required to get treatment for their condition in order to get health insurance.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I62. A person [“with major depressive disorder”/“with coronary artery disease”/“who is obese”] should seriously consider not having any children.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I63. A couple [“who both have major depressive disorder”/“who both have coronary artery disease”/“who are both obese”] should seriously consider not having any children.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I64. I would prefer not to spend time around [“a person with major depressive disorder”/“a person with coronary artery disease”/“an obese person”].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I65. I would rather not work with a person [“with major depressive disorder”/“with coronary artery disease”/“who is obese”].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I66. I would prefer that members of my family not get romantically involved with a person [“with major depressive disorder”/“with coronary artery disease”/“who is obese”].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I67. I would prefer that members of my family not marry a person ["with major depressive disorder"/"with coronary artery disease"/"who is obese"].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I68. I can understand why someone would prefer not to spend time around ["a person with major depressive disorder"/"a person with coronary artery disease"/"an obese person"].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I69. I would prefer that members of my family not get romantically involved with someone whose *parent* ["has major depressive disorder"/"has coronary artery disease"/"is obese"].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I70. I would prefer that members of my family not marry a person whose *parent* ["has major depressive disorder"/"has coronary artery disease"/"is obese"].

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I71. How willing would you be to spend time around ["a person with major depressive disorder"/"a person with coronary artery disease"/"an obese person"]?

Definitely willing 4
Probably willing 3
Probably unwilling 2
Definitely unwilling 1

The following questions ask about race-based medicine. Race-based medicine customizes medical treatments for specific racial groups. For example, the drug BiDil was developed by a company for use among only African Americans as a treatment for heart failure.

Even if you are unfamiliar with these topics, we are interested in your opinions.

I72. We could do a better job of treating coronary artery disease if drugs were developed for specific racial groups.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I73. Medications would work better if they were created for use in specific racial groups.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I74. In my opinion, we should only develop drugs that can be used by everyone regardless of their race.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I75. If coronary artery disease drugs were made for use with different racial groups, I would prefer to use the one designed for my racial group.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

I76. Drugs created for different races will reduce health inequalities in the United States.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

Now we have some questions about you and people you know:

I77. ["To your knowledge, have you or any close family members had major depressive disorder"/"To your knowledge, have you or any close family members had coronary artery disease"/"Have you or any close family members been obese"]?

Yes 1
No.....2

I78. ["To your knowledge, have any close friends of yours had major depressive disorder"/"To your knowledge, have any close friends of yours had coronary artery disease"/"Have any close friends of yours been obese"]?

Yes 1
No.....2

I79. How often do you read a traditional newspaper (one that is printed with ink on paper and NOT counting what you read online)?

Every day 5
A few times a week.....4
Once a week.....3
Less than once a week.....2
Never.....1

I80. How often do you watch news programs on television?

Every day 5
A few times a week.....4
Once a week.....3
Less than once a week.....2
Never.....1

I81. How often do you read news stories online?

Every day 5
A few times a week 4
Once a week 3
Less than once a week 2
Never 1

I82. How often do you attend religious services, watch religious programs on television or listen to them on the radio, or visit religious websites?

Daily 5
Weekly 4
At least once a month 3
Now and then 2
Never 1

I83. What country were you born in?

United States 1
Other country 2

I84. To the best of your memory, the article you read placed the most emphasis on which of the following factors as the basic root cause of ["major depressive disorder"/ "coronary artery disease"/"obesity"]?

Genetic Factors 3
A person's own decisions and actions 2
Factors in a person's social environment, such as stress and pressure 1

Thank you for answering our questions about the news article. That article was constructed from a variety of different news articles and reflects only one viewpoint among many views on this issue

For more information about ["major depressive disorder"/"coronary artery disease"/"obesity"], please refer to the ["National Alliance on Mental Illness website at http://www.nami.org."/ "American Heart Association's website at http://www.americanheart.org."/ "Centers for Disease Control and Prevention's website at http://www.cdc.gov/nccdphp/dnpa/obesity."]

Appendix B:

RACE VIGNETTE EXPERIMENT SURVEY

You will read a news article that we have provided for you. Most of the survey will consist of questions related to topics discussed in the article. You will also be asked some questions about topics not related to the article.

Please answer the following questions about racial issues in the U.S.

R1. Racial problems in the U.S. are rare, isolated situations.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R2. Talking about racial issues causes unnecessary tension.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R3. Racism is a major problem in the U.S.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R4. It is important for public schools to teach about the history and contributions of racial and ethnic minorities.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R5. It is important for political leaders to talk about racism to help work through or solve society's problems.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R6. Racism may have been a problem in the past, it is not an important problem today.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R7. Racial and ethnic minorities in the U.S. have certain advantages because of the color of their skin.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R8. In your opinion, the article provided an accurate account of the topics it discussed.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R9. In your opinion, did the article overemphasize, underemphasize or provide a balanced account of ["The degree to which people have mixtures of different racial backgrounds"/ "the degree to which racial groups are genetically similar"/ "the degree to which racial groups are genetically different"/ "the importance of genes in causing racial differences in heart attacks"]?

Strongly overemphasized [1] 5
Somewhat overemphasized [1] 4
Put the right amount of emphasis on [1] 3
Somewhat underemphasized [1] 2
Strongly underemphasized [1] 1

[Please populate 1 in the R9 answer options by using the following:

If *admixture* vignette, insert "the degree to which people have mixtures of difference racial backgrounds**".**
If *social construction* vignette, insert "the degree to which racial groups are genetically similar**".**
If *race is genetic* vignette, insert "the degree to which racial groups are genetically different**".**
If *genetic health difference* vignette, insert "the importance of genes in causing racial differences in heart attacks**".]**

R10. The article struck you as biased and inaccurate.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

[Please treat R11-13 and R14-18 as two sets, and randomize and record order.]

R11. Each racial group has a different profile of genetic risks for disease.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R12. A person's race can tell a doctor a lot about his or her genetic risk for many diseases.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R13. Racial groups have different genetic risks for most diseases.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R14. In terms of biological differences between people, race is a meaningless concept.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R15. Although black and white people may be alike in many ways, there is something about black people that is fundamentally different from white people.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R16. Different racial groups are all basically alike "under the skin."

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R17. There are very few genetic differences among racial groups.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R18. When you compare black and white people, you think they are:

Very similar 4
Somewhat similar.....3
Not very similar 2
Not similar at all.....1

R19. Think about the various racial and ethnic groups within the U.S. including Whites, African Americans, Asian Americans, Hispanics, Native Americans and so on. To what extent do you agree with the following statement?

Individuals who belong to the same racial or ethnic group tend to be fairly similar to one another.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R20. Now think only about racial and ethnic minority groups within the U.S. such as African Americans, Asian Americans, Hispanics, and Native Americans. To what extent do you agree with the following statement?

Racial and ethnic minority groups in the U.S. are very distinct and very different from one another.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R21. Think about Whites in the U.S. compared to racial and ethnic minority groups. To what extent do you agree with the following statement?

Whites as a group are very distinct and different from racial and ethnic minority groups.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

On average, black people in the U.S. have worse jobs, income, and housing than white people. There are many possible explanations for these differences. How much do you think these differences are…

	Very much	Some	Not much	Not at all

R22. …due to racial discrimination?
R23. …because most African Americans have less in-born ability to learn?
R24. …because most African Americans have less in-born drive to succeed?

On average, black people in the U.S. have worse health and shorter life-expectancy than whites. There are many possible explanations for these differences. How much do you think these differences are . . .

	Very much	Some	Not much	Not at all

R25. …due to genetic differences between blacks and whites?
R26. …due to racial discrimination?

African-Americans are much more likely to be arrested, jailed and imprisoned in the U.S. than are whites. There are many possible explanations for these differences. How much do you think these differences are . . .

	Very much	Some	Not much	Not at all

R27. …due to racial discrimination?
R28. …due to genetic differences between blacks and whites in their tendency toward violence?

People of African descent dominate many sports, such as basketball, football and running events. There are many possible explanations for these differences. How much do you think these differences are . . .

	Very much	Some	Not much	Not at all

R29. … due to genetic differences between blacks and whites?

For the following two questions, please choose the number from 1 to 7 that best represents your feelings.

R30. In general, how close do you feel to black people?

___	___	___	___	___	___	___
1	2	3	4	5	6	7
Not at all close			Neither one feeling nor the other			Very close

R31. In general, how close do you feel to white people?

___	___	___	___	___	___	___
1	2	3	4	5	6	7
Not at all close			Neither one feeling nor the other			Very close

R32. How would you feel about having a close relative or family member marry a black person?

Strongly favor 5
Favor 4
Neither favor nor oppose 3
Oppose 2
Strongly oppose 1

R33. How would you feel about having a close relative or family member marry a white person?

Strongly favor 5
Favor 4
Neither favor nor oppose 3
Oppose 2
Strongly oppose 1

R34. If you could find the housing that you would want and like, would you rather live in a neighborhood where:

All your neighbors belong to your own racial group 4
Most of your neighbors belong to your own racial group.....3
About half of your neighbors belong to your own racial group 2
Most of your neighbors do not belong to your own racial group 1

R35. Suppose you were thinking of adopting a child out of foster care. Suppose you were introduced to a child who is of a different race from you, and you were thinking of adopting this child. Would the race of the child be a concern for you in thinking about whether to adopt the child?

Major concern 3
Minor concern.....2
No concern 1

R36. How would it make you feel to receive a blood transfusion from someone who is of a different race than you?

Very uneasy 3
Somewhat uneasy.....2
Not uneasy at all.....1

R37. How would it make you feel to receive an organ transplant from someone who is of a different race than you?

Very uneasy 3
Somewhat uneasy.....2
Not uneasy at all.....1

The following questions ask about race-based medicine and personalized medicine. Race-based medicine customizes medical treatments for specific racial groups. For example, the drug BiDil was developed by a company for use among only African Americans as a treatment for heart failure. Personalized medicine is individualized medical care based on a person's genetic profile. Whereas race-based medicine is medical care that is customized to meet the needs of specific racial groups, personalized medicine is medical care that is customized to meet the needs of individual people based on their genetic differences.

Even if you are unfamiliar with these topics, we are interested in your opinions.

[Please treat R38-42 and R43-46 as two sets, and randomize and record order.]

R38. We could do a better job of treating heart disease if drugs were developed for specific racial groups.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R39. Medications would work better if they were created for use in specific racial groups.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R40. In my opinion, we should only develop drugs that can be used by everyone regardless of their race.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R41. If heart disease drugs were made for use with different racial groups, I would prefer to use the one designed for my racial group.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R42. Drugs created for different races will reduce health inequalities in the United States.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R43. We could do a better job of treating heart disease if drugs were developed based on individuals' genes.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R44. Medications would work better if they were created based on individuals' genes.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R45. In my opinion, we should only develop drugs that can be used by everyone regardless of their genetic make-up.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

R46. If heart disease drugs were made based on differences between everyone's genes, I would prefer to use the one developed for my gene type.

Strongly agree 4
Somewhat agree 3
Somewhat disagree 2
Strongly disagree 1

Next we have some questions about you and people you know.

R47. Are the people that you are acquainted with . . .

Almost all the same race as you 5
Mostly the same race as you 4
About evenly divided between the same race as you and other races 3
Mostly a different race than you 2
Almost all a different race than you 1

R48. How often do you read a traditional newspaper (one that is printed with ink on paper and NOT counting what you read online)?

Every day 5
A few times a week 4
Once a week 3
Less than once a week 2
Never 1

R49. How often do you watch news programs on television?

Every day 5
A few times a week 4
Once a week 3
Less than once a week 2
Never 1

R50. How often do you read news stories online?

Every day 5
A few times a week 4
Once a week 3
Less than once a week 2
Never 1

R51. How often do you attend religious services, watch religious programs on television or listen to them on the radio, or visit religious websites?

Daily 5
Weekly 4
At least once a month 3
Now and then 2
Never 1

R52. What country were you born in?

United States 1
Other country 2

Now we have a few more questions about what you remember about the article you read.

R53. To what extent did the article emphasize genetic similarities or differences between people of different racial backgrounds?

strong emphasis on genetic similarities between people of different racial backgrounds.....1
some emphasis on genetic similarities between people of different racial backgrounds.....2
some emphasis on genetic differences between people of different racial backgrounds.....3
strong emphasis on genetic differences between people of different racial backgrounds.....4
article did not discuss genetic similarities or differences between people of different racial backgrounds 5

R54. According to the article:

it is very easy to divide people into distinct races on the basis of their genes.....1
it is somewhat easy to divide people into distinct races on the basis of their genes.....2
it is somewhat hard to divide people into distinct races on the basis of their genes.....3
it is very hard to divide people into distinct races on the basis of their genes.....4
article did not discuss whether people can be divided into distinct races on the basis of their genes.....5

R55. To the best of your memory, the main point of the article you read was that:

people of different racial groups are genetically similar.....1
people of different racial groups are genetically different.....2
people's genes usually show that they have a mixture of racial backgrounds 3

Thank you for answering our questions about the news article. That article was constructed from a variety of different news articles and reflects only one viewpoint among many views on this issue.

Thank you for participating in our survey.

Appendix C:

HEALTH VIGNETTE EXPERIMENT CONTROL CONDITION VIGNETTES

Please read the following news article. You will be able to go back and re-read the article if you wish as you complete the survey.

Major Depressive Disorder focus of New Research Initiative

The National Alliance for Mental Illness has awarded several grants for the Depression Research Centers Initiative. The project will provide a network for research on the causes and treatment of major depressive disorder.

Center investigators will meet regularly and share information with each other, as well as provide training for research fellows.

Dr. Bruce Firman of Columbia University is one of the grant recipients. He is optimistic that the interaction among the centers will speed the growth of knowledge about major depressive disorder. "This is a situation where the whole will be much more than the sum of its parts," Dr. Firman said.

[DANIEL/KATHRYN] Link is also excited about this development. "I am very anxious to get answers about how best to deal with my condition. I just wish one of the centers was in Des Moines," [HE/SHE] said.

Coronary Artery Disease focus of New Research Initiative

The American Heart Association has awarded several grants for the Coronary Artery Disease Research Centers Initiative. The project will provide a network for research on the causes and treatment of coronary artery disease.

Center investigators will meet regularly and share information with each other, as well as provide training for research fellows.

Dr. Bruce Firman of Columbia University is one of the grant recipients. He is optimistic that the interaction among the centers will speed the growth of knowledge about coronary artery disease. "This is a situation where the whole will be much more than the sum of its parts," Dr. Firman said.

[DANIEL/KATHRYN] Link is also excited about this development. "I am very anxious to get answers about how best to deal with my condition. I just wish one of the centers was in Des Moines," [HE/SHE] said.

Obesity focus of New Research Initiative

The American Obesity Association has awarded several grants for the Obesity Research Centers Initiative. The project will provide a network for research on the causes and treatment of obesity.

Center investigators will meet regularly and share information with each other, as well as provide training for research fellows.

Dr. Bruce Firman of Columbia University is one of the grant recipients. He is optimistic that the interaction among the centers will speed the growth of knowledge about obesity. "This is a situation where the whole will be much more than the sum of its parts," Dr. Firman said.

[DANIEL/KATHRYN] Link is also excited about this development. "I am very anxious to get answers about how best to deal with my condition. I just wish one of the centers was in Des Moines," [HE/SHE] said.

Appendix D:

RACE VIGNETTE EXPERIMENT VIGNETTES

Please read the following news article. You will be able to go back and re-read the article if you wish as you complete the survey.

[*Admixture* Vignette]

Is it all black and white? Genes say 'No'

Most people think they know what race they belong to, and people tend to think of themselves as "100 percent" white or black or something else.

A recent study challenges that way of thinking.

Dr. Bruce Firman and other geneticists at Columbia University have developed a DNA test that measures a person's racial ancestry.

Results of the study were published yesterday in the journal Nature Genetics.

The test shows what continent a person's ancestors came from. These continents correspond to the major human population groups or races, those of "Native American, East Asian, South Asian, European, and sub-Saharan African" according to Dr. Firman.

If a person is of mixed race, the test shows the percentage of each race in a person's genetic background.

It turns out that mixed ancestry is very common, said Dr. Firman. About 10 percent of European-Americans have some African ancestry, and African-Americans, on average, have about 17 percent European ancestry.

When people are told the results of their DNA test, they are usually quite surprised. Most learn that they share genetic markers with people of different skin colors.

Some "black" subjects in the study found that as much as half of their genetic material came from Europe and some from Asia. One "white" subject learned that 14 percent of his DNA came from Africa and 6 percent from East Asia. Very few were 100 percent anything.

"The main outcome is that we are breaking down an either-or classification," Dr. Firman said. Instead of people being considered either black or white, the test shows a continuous spectrum of ancestry among African-Americans and others.

[*Social Construction* Vignette]

Is race real? Genes say 'No'

Most people would agree it is easy to tell at a glance if a person is Caucasian, African or Asian.

But a recent study suggests that it is not so easy to make these distinctions when one probes beneath surface characteristics and looks for DNA markers of "race."

Results of the study were published yesterday in the journal Nature Genetics. The study was conducted by Dr. Bruce Firman and other geneticists at Columbia University.

Analyzing the genes of people from around the world, the researchers found that the people in the sample were about 99.9 percent the same at the DNA level. "That means that the percentage of genes that vary among humans is around .01 percent, or one in ten thousand. This is a tiny fraction of our genetic make-up as humans," noted Dr. Firman.

The researchers also found that there is more genetic variation within each racial or ethnic group than there is between the average genomes of different racial or ethnic groups.

Why the discrepancy between the ease of distinguishing "racial" groups visually and the difficulty of distinguishing them at a genetic level?

Traits like skin and eye color, or nose width are controlled by a small number of genes. Thus, these traits have been able to change quickly in response to extreme environmental pressures during the short course of human history.

But the genes that control our external appearance are only a small fraction of all the genes that make up the human genome.

Traits like intelligence, artistic talent and social skills are likely to be shaped by thousands, if not tens of thousands of genes, all working together in complex ways. For this reason, these traits cannot respond quickly to different environmental pressures in different parts of the world.

This is why the differences that we see in skin color do not translate into widespread biological differences that are unique to groups and why Dr. Firman says "the standard labels used to distinguish people by 'race' have little or no biological meaning."

[*Race Is Genetic* Vignette]

Is Race real? Genes Say 'Yes'

Most people would agree it is easy to tell at a glance if a person is Caucasian, African or Asian.

A recent study suggests that the same racial groups we can identify do in fact correspond with broad genetic differences between groups.

Results of the study were published yesterday in the journal Nature Genetics. The study was conducted by Dr. Bruce Firman and other geneticists at Columbia University.

Dr. Firman says that racial differences exist because early humans in Africa spread throughout the world 40,000 years ago, resulting in geographical barriers that prevented interbreeding. On each continent, natural selection and the random change between generations known as genetic drift, caused peoples to diverge away from their ancestors, creating the major races.

The effects of this natural selection and genetic drift that have followed different pathways on each continent can be seen by looking at people from different racial groups as traditionally defined. Certain skin colors tend to go with certain kinds of eyes, noses, skulls and bodies.

When we glance at a stranger's face we use those associations to guess what continent, or even what country, he or his ancestors come from – and we usually get it right.

What Dr. Firman and his colleagues showed was that genetic variations that aren't written on our faces – that can be seen only in our genes – show similar patterns.

The researchers sorted by computer a sample of people from around the world into five groups on the basis of genetic similarity. The groups that emerged were native to Europe, East Asia, Africa, America and Australasia – the major races of traditional anthropology.

Hence, Dr. Firman says, "race matches the branches on the human family tree as described by geneticists."

[*Genetic Health Difference* Vignette]

Genes May Cause Racial Difference in Heart Attacks

Doctors have long known that African Americans are prone to heart attacks. In fact, not only are African Americans more likely to suffer from heart attacks, their heart attacks are more likely to be fatal, compared to Caucasians.

A recent study suggests that genetics may help explain this racial difference.

Dr. Bruce Firman and other geneticists at Columbia University detected a version of a gene that raises the risk of heart attack in African-Americans by more than 250 percent. That means the gene more than doubles the risk of heart attack in African-Americans.

Results of the study were published yesterday in the journal Nature Genetics.

The gene identified by the researchers is called leukotriene A4 hydrolase. The gene is involved in inflammation.

Inflammation, which we commonly see as swelling, redness and pain, is the process by which the body responds to injury or infection. Inflammation is usually beneficial to health. But new evidence shows that inflammation plays a key role in causing heart attacks. Too much inflammation seems to damage the lining of artery walls and contribute to the buildup of fatty deposits (called plaque) inside the artery.

Plaques block the flow of blood through the arteries, leading to heart attacks. Inflammation can also cause plaques to burst, which scientists think is a cause of heart attacks.

Dr. Firman said that the gene they identified is much more strongly associated with heart attack in African-Americans than in Caucasians.

"These findings," said Dr. Firman, "offer strong evidence that genetic factors are important in explaining the higher rates of heart attack in African Americans."